RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. IX OCTOBER, 1927 No. 4

METHODS OF RADIATION THERAPY IN DERMATOLOGY[1]

By ROLLIN H. STEVENS, M.D., F.A.C.R., F.A.C.P., DETROIT, MICHIGAN

TO apply radiation therapy intelligently to any disease, it goes without saying that one should be familiar not only with the natural history of the disease, but should also have practical knowledge of the physics and biochemical action of the therapeutic agent to be employed. The less the prerequisite knowledge, the greater the empiricism of the treatment and the variability of results.

The field of radiation therapy has been most attractive to a large class of medical men because the apparatus used was new, was enshrouded in more or less mystery, and stimulated the psychology of both patient and physician. Manufacturers could not make their business pay if they catered only to the few specialists more or less competent to use their product, so they employed agents, whom they instructed in a very few of the rudiments of radiation physics and therapy, sending them out among the profession to demonstrate and sell their wares to as large a number as possible. One result is, as might be expected, the fostering of the rankest kind of empiricism and even quackery. But, fortunately, it has also stimulated the interest of the scientist and well-equipped clinician, who have been busily engaged in an effort to separate the chaff from the wheat.

The sun-priests of the primitive races of men, even in prehistoric times, knew that sunlight was essential to life. Ancient and modern Zuni Indians of New Mexico worshipped the sun as the "Mother Life God," that is, the source of life, and probably knew almost if not quite as much about the therapeutic action of light as do some of our modern "sun-priests" of the medical profession.

The development of group medicine and the co-operation of physicist, biochemist, and clinician in some of the well-equipped hospitals of the world, have all served to give us a better understanding of the therapeutic applicability of the various forms of radiation. From the investigations of these groups and institutions, we have at least learned to regard our knowledge of the subject with humility, and to realize that we have only just entered the threshold of the most important secret chamber, containing the knowledge that is even now revolutionizing the practice of medicine. If we are not prevented by the ignorant, religious fanatics, known as antivivisectionists and fundamentalists, who by dangerous and obnoxious legislation are now seriously menacing our freedom and progress in several States of this supposedly democratic and free country, we should in the next decade or two accumulate sufficient knowledge on the subject of radiation to enable us to control many diseases that are now taking a heavy toll of life.

[1]Read before the Radiological Society of North America, at Milwaukee, Nov. 29–Dec. 4, 1926.

Rays change the cells and their fluid media in many ways and so alter their chemistry and physiology. The products of these changes, in turn, react upon other cells, also upon the mineral and fluid media which bathe and nourish them, the colloids, so that the constitution of the individual is changed in part or in whole. These actions and reactions, no doubt primarily involving the grosser chemical affinity of the molecules and the electrical balance of the atom, are complex—and our knowledge of them is yet very crude and indefinite.

The radiations which are made use of in dermatology to-day include a large part of the known electromagnetic spectrum, which, we are told, comprises some eighty octaves of radiant energy. Only one-eightieth part of this is represented in the luminous rays with wave lengths of from 3,900 to 7,700 Ångstrom units. All the other seventy-nine-eightieths of the known field of radiations comprise rays which we do not sense with our eyes except when chemical or physical agents are made use of to give us ocular demonstration of their presence.

The rays at present employed, in the order of their wave lengths, are as shown in the tabulation on page 271.

SENSITIZATION TO LIGHT

Duke has described cases which developed urticaria when exposed to light. Bazin, in the '80's, described hydroa vacciniforme, which attacked children on exposure to light. Later, in 1889, Hutchinson described a group of skin diseases which he called "summer prurigo," occurring after exposure to light. These cases are rare and are said to be associated with the presence of hematoporphyrin in the various tissues, and also in the urine or stools.

Walther Hausmann (1) reports light stroke in lower animals and in man. Light-haired cattle which have eaten buckwheat and remained in the open have suffered "light death." Mice given porphyrin and exposed to light suffer "light stroke." Dr. Betz took 0.2 gram of porphyrin in October and suffered a mild light stroke in December.

Fluorescent substances, like eosin and quinine, in the system of an individual exposed to light sometimes produce very severe skin lesions, which may at times resemble those of syphilis or leprosy. One case was reported by Hausmann, with ulceration of, and loss of, nails. Bacteria may not be killed by ultra-violet light, but if a small quantity of eosin is added, they are sensitized, and much more quickly destroyed.

Hausmann also reports cases of dermatitis from covering the face with vaseline and exposing it to light. Similar experiences have occurred with tar fumes. He says that occasionally there is a predisposition to melanosis from light after injection of salvarsan, and this has some relation to pellagra.

Pellagra.—This disease certainly bears some relationship to light. It was thought to be a light sensitization to something in corn, but this hypothesis is no longer held. As Hausmann suggests, the relationship of abundance or deficiency of light to avitaminosis might give a clue to its etiology.

Xeroderma pigmentosum:—This disease is apparently due to some susceptibility in the child, so that, upon its first exposure to light, it develops the erythema and pigmentation, with later scaling, keratoses, ulceration, and development of true carcinoma of the skin. It closely resembles chronic X-ray dermatitis, or the chronic degenerative changes seen in the faces of some sailors or farmers who finally develop carcinoma. It seems that after the first exposure to light the disease is progressive like all malignancies, further light exposure having no particular effect.

1. Hertzian Ray, 3 mm. to many meters — Very penetrating heat waves, which can be graduated from a mere sense of warmth to actual cooking and destruction of any animal tissues.

2. Infra-red Rays, 8,000–3,100,000 Å. — Those nearest the Hertzian waves are very superficial in action and would be absorbed in the epidermis, while those nearest the red rays are more penetrating. They produce heat, and more pain than the luminous rays.

3. Luminous Rays, 3,900–7,700 Å.

Source { Sunlight / Carbon-arc Light

The red rays penetrate into the muscles and joints and create heat there. Carl Sonne, of Copenhagen, thinks this heating of the sanguiferous layers of the subcutical tissues has an important bearing on the therapeutic results of light. The sense of heat is regarded by Dally as an index of the sufficiency of the dose to produce an erythema, which constitutes the biological dose usually aimed at for producing immunity in the tissues. Too much heat from irradiation may produce serious consequences and even death.

4. Ultra-violet Rays, 2,000–3,900 Å. Explored

Source {
- Sunlight—rich in longer near-ultra-violets in high ground and near sea in clear air.
- Carbon-arc Light—rich in longer near-ultra-violets.
- Iron-arc Light—rich in middle near-ultra-violets.
- Mercury Vapor Light in Quartz—rich in middle ultra-violet rays.
- Tungsten Arc Light—yields largest number of far ultra-violet rays.

Unexplored Ultra-violet Rays, 12 to 500 Å.

Extreme: 500 to 2,000 Å.—Absorbed by the oxygen of the air.

Middle: 2,000 to 3,000 Å.—Penetrate only 80 to 130 microns into corneal layer of epidermis.

Near: 3,000 to 3,900 Å.—Penetrate to capillary layer in cutis.

5. X-rays, 10 or 12 to 0.01 Å.

12,000 volts—Very long X-rays absorbed in corneal layer of epidermis.

50,000–110,000 volts—Largely absorbed in true skin and deeper subcutaneous tissues.

150,000–250,000 volts—Penetrate all the way through the body and largely absorbed in the deeper tissues from 5 to 15 cm. below the skin portal.

6. Radium Rays, 0.01 to 0.001 Å.

Alpha—Atomic particles absorbed by a thin sheet of paper: no therapeutic value.

Beta—Electrons of various velocities. The most rapid of these absorbed by 1 mm. of silver.

Gamma—Various wave lengths and penetrabilities. Longest absorbed by 0.5 platinum or 1 mm. of silver. Shortest absorbed by 12 or 13 cm. of lead.

Finsen (2) showed, in 1903, that variola was made suppurative by exposure to daylight in the early stage of the disease. If these cases are treated in the red light of a dark room in which photographic paper would be safe, the pustular eruption and secondary pneumonic infections will not occur.

Babies vaccinated will have but little scar if protected from the light.

Varicella has a similar relationship to light.

Pfahler (3) has shown that the ultra-violet light sensitizes the skin to X-ray to a very marked degree, so that the theory which has been advanced by some ultra-violet light enthusiasts, that a previous exposure to ultra-violet light would prevent X-ray burns, or an exposure after an overdose of X-ray would prevent burns, has been exploded. One should use great care in treating these cases with X-ray after exposure to ultra-violet light, and *vice versa*.

Syphilis may sensitize to roentgen ray. Gösta Forssell (4) states he is convinced that a previous luetic infection or eventually a hereditary syphilis which has produced a weakness of the vascular system involves enhanced risk of later-appearing lesions from roentgen ray. He treated an eczema at the back of the knee joint with a dose of X-ray that did not produce erythema. Six years later a deep necrotic ulcer appeared in the treated area. In three more cases of late roentgen necrosis coming under his notice there have been luetic infections.

The application to the skin of certain chemicals, such as iodine, chrysarobin, etc., sensitizes the skin to the action of X-ray.

THE ACTION OF ULTRA-VIOLET LIGHT IN INFECTIONS

Edinow, at the National Institute for Medical Research, has shown that ultra-violet rays shorter than 3,000 Å., applied in erythemic dose, would increase the bactericidal power of the blood. It was necessary, however, to expose for 5 minutes an area of skin 40×60 sq. cm. per kilo of body weight to secure the optimum results. Small areas, 1 to 5 cm., exposed 5 or 60 minutes, made no difference in the blood. Thus, time was not so much of a factor as area treated. As large areas as 80 to 120 sq. cm. per kilo of body weight failed to improve the hemobactericidal power. Clinically, he found that an exposure of the back of a patient up to the iliac crest, an area of approximately 154 sq. cm., usually increased the hemobactericidal power. Thus, if we wish to improve a case of chronic furunculosis, extensive acne, or other infection, where the bactericidal power of the blood is apparently below par, it will be well to bear in mind this relationship of size of area treated to this important action on the blood.

Hans Meyer (5), referring to the experimental work of Carl Neuberg, says that solar light can activate the ferments of oxidation in the body, but this process follows the old Arndt-Schulz law, namely, that the light in a certain amount first increases this ferment activity, then decreases it, and if the light dose is further increased the activity is completely destroyed.

Hence, it is of great importance that we learn as soon as possible more about the relationship of time, quality and quantity of dose of light, and size of area exposed to the general systemic reactions.

Finsen's classical work in the treatment of lupus vulgaris of the skin and mucous membrane was based on the plan of concentrating the light, first from the sun, later from carbon arcs, and conducting this through the skin in small areas dehematized by means of pressure. The quality of the light was tested by its ability to penetrate through the skin and kill bacteria. This property was thought to be due largely

to the blue, violet, and longer ultra-violet rays contained in such light. The whole luminous spectrum, however, was used. During the last few years they have found that about 20 per cent of cases of lupus vulgaris may be cured by carbon arc light baths alone, applied to the whole body. So this treatment is now used in combination with the same concentrated light used thirty years ago, in which small areas not over 2½ cm. in diameter were treated with pressure by a skilled nurse for 1 hour 25 minutes, and the results have been very satisfactory. Similar results cannot be accomplished by ultra-violet rays alone from either the iron arc lamps or mercury vapor lamps. The ultra-violets from these lamps are of shorter wave length and do not penetrate deeply enough into the skin. Besides, these lights contain but few of the luminous rays, which are now considered important for this particular work.

Claims are made that lupus vulgaris may be promptly and easily cured by desiccation (surgical diathermy). We have had no experience in treating this disease by this method, but it would seem as though the treatment would have to be experimented with in centers where there are large numbers of lupus cases, as in Northern Europe, and the results judged after a considerable lapse of time in order to demonstrate any equality with, or superiority over, the Finsen methods. In deep-seated lesions, particularly those involving the nose, ears, eyelids, lips, etc., the results of such treatment as surgical diathermy would surely be too deforming to compare favorably with the light, which, of itself, would leave no scar.

Neither operation, X-ray nor radium has yet proven successful in the treatment of this disease, and would no longer appear to be indicated except as occasional adjuvants to the light.

In lupus erythematosus, on the other hand, the Finsen light was tried faithfully over many years, but, while temporary improvement usually followed, relapses were the rule, and the light treatment has now been abandoned in these cases and carbonic snow has been found to be a very successful substitute. The etiology of lupus erythematosus, which is as frequently seen in this country as elsewhere, is supposed to be a toxin from a focal infection not necessarily tuberculous.

Of course, the first duty in the treatment is to seek out the cause and remove it, if possible. Schoenhof (6), of Prague, treated 14 cases indirectly with X-rays by radiating the drainage lymph nodes of the area affected. Four cases were cured and 10 much improved. Other reports of a similar nature are seen in the literature. The idea is that it is the lymphatic glands that are supplying the toxin which causes the lupus, so that the indications are to treat the glands.

Several years ago we had a case of lupus erythematosus of the nose which resisted long continued light treatment. The patient had had a severe obstipation all her life. After treating unsuccessfully with ultra-violet light (water-cooled, with pressure) we discovered by roentgen examination an extensive Jackson's veil about the colon, rotating the latter. The patient was operated on by Dr. Frank Kelly, the veil removed, and before she left the hospital her bowels were moving normally. Then after two treatments with ultra-violet light the lesion on the nose disappeared and after several months, at least, had not recurred. Evidently, in this case, absorption of toxins from the colon was probably a strong etiological factor.

Perhaps too often, in dermatological practice especially, we are prone to treat a local manifestation of disease when its cause is elsewhere, and must be removed before a cure can be effected. As our knowledge of etiology increases we treat by radia-

tion, with some success, internal secretory organs which may be responsible for the local manifestation.

Schoenhof (7) reports several cases of amenorrhea followed by development of chronic diseases of the skin or by exacerbation of a chronic dermatosis already present, which, after receiving a stimulating dose (1/10 erythema dose) of X-ray to the ovaries, experienced an immediate establishment of the menses and disappearance or abatement of the skin lesions. We have had a few similar experiences.

Similar results have followed stimulating doses to the thyroid, thymus, or pituitary. Diseases which have been thus relieved are psoriasis (improvement), chronic lichenoid pityriasis, atrophic para-psoriasis, alopecia areata, seborrheic dermatitis, eczema, etc. Do not think such treatment a panacea for the diseases named. Only isolated cases have been so relieved, where causal or at least sequential relationship with the distant organ treated could be traced.

Eczema.—W. J. Highman (8), in a most convincing thesis on eczema and dermatitis, states: "Eczema is the result of a skin idiosyncrasy to precipitating causes, external in a preponderance of cases and internal in the remainder. It is not an external disease or an internal disease. It is both, always, and at one and the same time."

Patients with eczema may be victims of any one of a host of internal disturbances, for the most part grouped under nervous, digestive, and metabolic. These may be related to anaphylaxis. The known external precipitating causes are too numerous to mention, let alone conjecturing upon the unknown. They include a countless number of agents to which the skin itself may be susceptible, such as ivy, primrose, dyes, chemicals and drugs of all sorts, fungi, bacteria, etc.

As Highman says, in referring to disturbances of ductless glands and nitrogen metabolism as causes of eczema, they are only related causes. We quote: "When Bloch recalls the frequency with which a patient, under unavailing restrictions of diet ordered because of an alleged metabolic disturbance, becomes rid of the eczema on the discovery of primrose excitability, he states a truth within the experience of all. He says, the 'diathesis' vanishes. It does. One is reminded of how scabies was explained as eczema, still is, by all of the miasmatic hypotheses that rise from the bog of ignorance, until some one found a sensible solution."

Treating primrose or other plant dermatitis, epidermophytosis, drug dermatitis, solar dermatitis, diabetic dermatitis, etc., by radiation is futile—they are all eczemas in which radiation is generally not indicated. In some of these cases, such as epidermophytosis, X-ray is helpful in relieving the eruption temporarily, but does not cure it. One persistent case of epidermophytosis, involving the toes, which resisted for a long time the usual treatment, finally cleared up, permanently, under water-cooled ultra-violet light treatment, with pressure. Air-cooled ultra-violet light will also help many cases of eczema regardless of cause, but unless the latter is removed the case will not be cured.

Sven Lomholt (9), of the Finsen Institute, Copenhagen, reports on the treatment of nearly a hundred cases of chronic eczema with concentrated Finsen light. There were about 60 per cent of complete cures, 25 per cent of the remaining 40 per cent were much improved, while 15 per cent were unimproved. None were made worse. These cases included some stubborn ones that had been treated with X-ray without permanent benefit. Exposures were made with concentrated carbon arc (Finsen) light, with pressure, for 15 or 20 minutes. We have had some similar results, but found the

work too tedious without competent nurses to operate the light.

Psoriasis.—No one knows the cause of psoriasis. X-ray and actinic light have been used in the treatment of this disease for about thirty years, but everyone's results are about the same, namely, temporary improvement, with relapse. I have cautiously treated a number of cases with combinations of water-cooled ultra-violet light, with pressure, and by means of X-ray. These cases, I think, have remained well longer than cases treated with one of the agents alone. With the quartz applicator I make pressure with light in close contact, 30 to 40 seconds, and I do not give more than half to two-thirds of an erythema dose of X-ray, using a millimeter of aluminum filter and about 90,000 volts. Irradiation of the whole body to air-cooled light clears up lesions quickly in some patients, but does not influence them markedly in others. Some patients get prompt relief from sea-bathing in summer, but the sea-water, I think, plays an important part in these cures, for I have seen the same result from intramuscular injection of isotonic sea-water.

Pityriasis rosea.—The course of this disease can be shortened 50 per cent by the use of air-cooled ultra-violet light to the whole body.

Impetigo contagiosa is benefited by moderate doses of ultra-violet light, with pressure, but other local antiseptic measures must be employed.

Furunculus and carbunculus.—These usually respond quickly to mild doses of X-ray of about 85,000 to 90,000 volts applied at intervals of one or two days. In carbuncles, I feel sure this is the method of choice and is a great improvement over surgery in saving time, dangers of metastatic infection, and serious scars; but the number of such cases referred is small and I cannot speak from a large experience. The effects of ultra-violet light in raising the bactericidal power of the blood should be tried in these cases as well as in erysipelas and other infections.

Cheilitis exfoliativa (inflammation of mucous glands of the lip).—This condition I regard as likely to lead to carcinoma and I employ X-ray therapy, with confidence, using heavy filtration—3 to 4 mm. of aluminum and sole leather and moderately high voltage—90 to 100 K.V.

Lichen planus.—This disease usually responds temporarily to X-ray treatment but is likely to relapse. Careful search should be made for a possible constitutional underlying or related cause. The nervous condition is supposed to play an etiological rôle and must be sought out and treated. Sometimes the disease will clear up quickly under X-ray and remain clear. I have had no experience with ultra-violet light in the treatment of this disease.

Prurigo is too rare here to provide me with any experience. Reyn, at the Finsen Light Institute, in Copenhagen, claims good results from the carbon arc light baths.

Herpes zoster.—We have tried several times to relieve the pain and inflammation of this disease by mild doses of X-ray applied both to the local manifestation and the region of the spinal nerve roots, but have seen no beneficial results. Theoretically, exposures of the back or chest and abdomen to erythema doses of ultra-violet should be of value.

Warts and *corns* respond to heavy doses of X-ray. We usually give five or six times the erythema dose, limiting the treated area strictly to the wart or corn. This is the only satisfactory treatment for plantar warts. We usually use no filter. In cases of multiple warts on the face, especially of a child, we use X-ray treatment with filter, giving divided doses once a week until just under an erythema dose has been given. These multiple warts are sometimes very sensitive to X-ray and disappear rapidly; at

other times they are very resistant. But I know of no better treatment.

Morphea.—We have one peculiar case of undoubted morphea involving extensively both wrists, mostly on the palmar surfaces, the dorsal surfaces of both ankles, and one patch on the medial side of one thigh in which moderate dosage of X-ray well filtered (6 mm. of glass), 90 K.V., has cleared up most of these patches. Those on the feet did not respond so well. Those on the wrists and thigh cleared. A slight relapse occurred a few months later on one wrist, but at last accounts this was clearing after further X-ray treatment. So far as I know, this is the only case of morphea reported as treated and improved by X-ray.

Leukoderma.—I treated one case, a young unmarried woman, with large symmetrical patches on the breasts and the neck. She worried a good deal about the condition and insisted on something being done. We applied water-cooled mercury vapor light, with pressure. It was interesting to watch small islands of pigmented skin appear very slowly in the white spots over a period of several months, until the depigmented areas, except one, finally became normal appearing skin. The patient has not returned for the past two years, so I do not know the final results, but this experiment demonstrated that it is possible to cause return of pigment to depigmented areas of leukoderma. No cause could be determined and no other treatment was given.

Xanthoma palpebrarum. — Three cases were successfully treated in 1905 with Finsen light (pressure). Two similar cases failed to respond. The first two cases were of long standing and involved both eyelids extensively, in middle-aged women. The tumors were exposed for an hour and one-quarter, with pressure, with the quartz "pressure-glass"—about the same time as required for the treatment of lupus. The skin appeared normal after treatment, there being no scars. I doubt if similar results could be accomplished with the mercury vapor ultra-violet light as it is hardly penetrating enough. Of course, such treatment as was given these cases was long and tedious for both doctor and patient, as each lesion had to be treated at least twice, and after each treatment swelling and crusted weeping of the skin took place and lasted for about ten days, when the operation was repeated. Gradually the tumors were absorbed. Sven Lomholt (10) reports 20 cases of xanthelasma palpebrale cured by Finsen concentrated light at the Finsen Institute at Copenhagen: 4 to 6 hours' exposure was necessary for each growth.

Pruritus.—Perhaps the X-ray has been used in few skin diseases more often than in pruritus. The results at first are often brilliant in pruritus ani and vulvæ, but relapses recur. I dread to think of the damage that may have been done to some of these cases without their getting relief for any great amount of time. The etiology of these conditions is difficult to locate and almost any treatment is often discouraging. If the cause can be found and eliminated, X-ray will not be indicated. One must not forget the work of Little and others in producing mice, which, after the second generation on for fifteen or more generations, had a mendelian inheritance of monstrosities following a dose of radiation to the ovaries or testes of the original parents which was insufficient for castration. Therefore, we should be exceedingly cautious about applying even small doses about the genitals of individuals in the sexually active period of life. If the ray is used and relief does not come after one or two mild, well protected exposures, I would think this form of treatment would better be discontinued. In general pruritus, the X-ray is hardly indicated unless leukemia, Hodgkin's, lymphosarcoma, or mycosis fungoides which would be relieved by X-ray, are found to be pres-

ent. In these latter diseases we have used injections of radium chloride with much benefit.

Molluscum contagiosum.—These lesions will retrogress under heavy X-radiation. A much simpler and more certain way, however, is to apply phenol to the cavities after expressing the contents. Desiccation may be used if there are not too many lesions.

Nevi and telangiectases.—In young infants port wine nevi, if not over 2 cm. in diameter, are perhaps best treated by radium plaques. Our method for several years has been to use a plaque containing 2 mg. of radium sulphate, ¼ pure, distributed over a surface 2.5 cm. sq. This, with a filter of 8 sheets of thin paper, may be left on 7 or 8 hours and will produce a very slight erythema. One, or, at the most, two treatments, two months apart, usually suffice to cure a case, but it will take a year or longer for the color to fade out. Where there are much larger areas, such as involvement of most of one or both cheeks, the radium has not been so successful. These cases could be treated later by concentrated carbon arc light (Finsen) or by water-cooled mercury vapor light, with pressure. There is danger of very persistent pigmentation from the latter light, and William Clark, of Philadelphia, found that the violet colored quartz window would prevent this, but the treatment would have to be applied 40 minutes to a spot. Macleod (11) in his book states, without qualification, that radium is the best treatment for port wine nevi. He also says that ultra-violet light and the Finsen light, while theoretically of value, practically are of little value as it is almost impossible, unless with long exposures, to obtain a sufficiently powerful inflammatory reaction to produce the necessary fibrous changes. We have accomplished very good results in port wine nevi with the Finsen light. Of course, long exposures are necessary. In extensive port wine stains, especially in adults, our experience with radium has been unfavorable.

Spider-nevi are easily cured by electrolysis or desiccation. Radium does not work so well.

Raised hemangiomata respond very readily to radium treatment. Our first case treated by this method was in 1910. A baby girl 5 months old had a raised nevus on the end of the nose which stood out about like a cherry. Two applications of the 2 mg. plaque filtered through 0.1 mm. of silver and paper for 17 hours, two months apart, resulted in a complete cure. We saw this child at the age of 12 years and there was not the slightest evidence of there having been any pathology in this region. The most revolting and hopeless appearing case of this kind came to our attention in 1922. The face and neck of a baby girl 4 months old were literally covered with irregular, raised, bright red hemangiomata from 0.5 to 1 cm. across the base. They were elevated several millimeters above the skin. Some about the nose had been scratched open and were ulcerated and bleeding. The nose and lips were swollen and deformed. Small bits of skin, between the elevations, were red. The first impression was that these hemangiomata were large drops of blood on a raw surface. The face looked like bloody raw meat—a most horrible appearance. We treated the entire face and neck with radium plaques containing 2 mg. and 5.19 mg., respectively, also some 10 mg. needles were used, as considerably more radium was required than we had in the plaques. The result was practically a complete cure. Every bit of color and all the elevations were made to disappear and two years later the child, while not at all pretty, was not bad looking. The only scars were from the ulcers about the nose where she had scratched open the hemangiomata. A case of port wine nevus, involving the entire face and part of the neck, was treated by us by the same method

at about the same time, but the results were absolutely negative. We are now waiting for this child to grow older when we shall treat it with concentrated light, a most tedious process.

The *non-vascular nevi* cannot be treated very satisfactorily by radium alone as it increases the pigment. Hairs in the nevi may be removed by this method. If the pigmentation is such as to make the nevus suspicious for malignancy, radium would better be used anyway. Much of the pigment can later be removed by carbonic snow. Many of these lesions are best treated by desiccation, which can also remove the hairs.

We have successfully treated one case of *lymphangioma circumscripta* in the upper sternal region in a little girl of 4 years. There was a cluster of several deep-seated lymphatic vesicles, like sago grows, in the skin, extending over an area 4 cm. long. A 2-milligram plaque filtered through 0.1 mm. of silver and 6 sheets of thin paper was applied for 17 hours.

Epitheliomata and keloids respond equally well to X- and gamma rays. Formerly we used one large, often unfiltered, dose of X-ray in epitheliomata. Our practice now is different and much more effective. We give two to five erythema doses of highly filtered ray with 90,000 to 100,000 volts, sometimes using 200,000 volts and a millimeter of copper. This is given in units extending over a week or ten days. Or, occasionally, we use Kingerer and Pfahler's saturation dose method. If radium is used, we apply 5 milligrams of radium in steel needles in 1.5 mm. of platinum, 1 cm. to 2 cm. apart (the number depending upon the size of the lesion), at a distance of 1 cm. to 2 cm. for from 5 to 7 days. This is after Régaud's technic, but Régaud uses smaller units—about 1 to 2 mg. We propose to have our radium in smaller units later. If the growth is of the differentiated-cell-type, the drainage glands are treated by deep X-ray therapy, or, preferably, by radium packs over long periods.

Sarcoma cutis and multiple hemorrhagic pigmented sarcoma (Kaposi) respond, temporarily, to mild radiation, but are likely to recur. Deep high voltage X-ray therapy, we believe, is much more effective than the lower voltage.

Granuloma, or mycosis, fungoides.—We have treated six cases of this disease with X-ray and two of them, well advanced in the tumor stage, had arsphenamine as well. The first case was treated from 1905 to 1910, after having been in the pre-mycotic stage for two years. The patient began to develop tumors only during the last few months of his life. He was treated with unfiltered and unmeasured X-ray at first, but never developed any burns. He was comparatively free from the intensely pruritic eruption for a considerable part of five years, and died seven years after the disease began. Three other cases treated within the last four years had accurately measured and filtered radiation, but their terms of life were much shorter. However, none of the three continued treatment very faithfully. Using arsphenamine with X-ray, according to the suggestion of the late Dr. John Fordyce, in two cases produced no better results than the X-ray alone. In one advanced case, treated in the past year, we secured immediate and lasting relief from itching, together with improvement in the dermatitis, by the injection of 100 microcuries of radium chloride, repeated at irregular intervals of from two to six or eight weeks. Deep X-ray therapy was also given this case, but death followed eight months after beginning treatment.

Acne vulgaris.—In our experience the X-ray treatment of acne vulgaris is the most satisfactory of any. We use 1 mm. of aluminum, 85 to 90 K.V., and give half to two-thirds of an erythema dose once in two to four weeks. We have rarely used ultra-

violet light because of the necessary erythemas resulting.

Dermatitis capillaris capillitia.—We generally give X-ray in a higher filtration in the treatment of these cases, and with success.

Acne varioliformis à tuberculid.—We have treated and cured two cases of this by Finsen light treatment.

Sycosis non-parasitaria.—These cases respond well to X-ray treatment but are likely to relapse.

Tinea trichophytina of the scalp.—The usual epilation treatment by X-ray, as introduced by Sabouraud, has been very successful.

Favus.—We have successfully treated two cases by this same method, which I believe was first suggested by Freund (12) in 1902.

Onychomycosis.—We do not depend upon the X-ray alone to cure these cases, though we always use it, but only in connection with fungicides and scraping the nails. They are tedious and difficult cases to cure. Perhaps complete avulsion of the nails, while a radical procedure, is best.

Blastomycosis.—We have had a limited experience with the therapy of this disease but have successfully treated two cases with simple lesions of the neck by X-ray, together with potassium iodide internally.

CONCLUSIONS

In conclusion, radiation therapy, properly selected and applied, is of great value in a large number of skin diseases.

Careful diagnosis, however, should first be made by competent dermatologists, and the etiology of the disease religiously sought after and removed, if possible. If this is done, more cases will be actually cured and fewer cases will be subjected to unnecessary and possibly injurious radiation.

Radiation is not a cure-all by any means, and its use is largely empirical at the present time.

REFERENCES

(1) HAUSMANN, WALTHER: Strahlentherapie, 1926, XXII, 205-236.
(2) FINSEN, NIELS R.: Hospitalstidende, March, 1894.
(3) PFAHLER, GEORGE E., KLAUDER, J. V., and MARTIN, J. L.: Am. Jour. Roentgenol. and Rad. Ther., August, 1926, XVI, 150-154.
(4) FORSSELL, GOSTA: Discussion of paper by Axel Reyn, Acta Radiologica, 1926, III, 241.
(5) MEYER, HANS: Strahlentherapie, 1926, XXIII, 369.
(6) SCHOENHOF, S.: Strahlentherapie, 1926, XXII, 148.
(7) Ibid.
(8) HIGHMAN, W. J.: Archiv. Dermat. and Syphil., March, 1925, XI, 303-330.
(9) LOMHOLT, SVEN: Brit. Jour. Dermat. and Syphil., February, 1923, XXXV, 45-49.
(10) LOMHOLT, SVEN: Brit. Jour. Dermat. and Syphil., March, 1924, XXXVI, 112-115.
(11) MACLEOD, J. M. H.: Diseases of the Skin. H. K. Lewis & Co., London, 1920, pp. 184, 185.
(12) FREUND, L.: Wien. klin. Wchnschr., March 25, 1926, XXXIX, 349-353.

A SOURCE OF ASTHMA IN CHILDREN[1]

By T. D. CUNNINGHAM, M.D., DENVER, COLORADO

BRONCHIAL asthma and asthmatic bronchitis in children would be far too large a subject to take up at this time. It is the purpose of this paper to discuss merely one source of asthma in children, which, judging from the lack of literature on the subject, has not received its proper emphasis. The reason for this is the generally accepted idea that small children do not have sinuses, or only very rudimentary ones, and that they do not become infected, or, if they do, they have no importance. Therefore, it seems timely to call attention to infected sinuses as important sources of asthma and bronchitis in children.

Fig. 1 *A*. Sinus of boy, aged 13 years. Five years of sinus trouble preceding asthma. Child is sensitive to practically all foods. Was relieved of asthma on change of climate, although eating foods to which he is sensitive.

Fig. 2 *A*. Sinus of child, aged 3 years, with asthma. Sensitive to practically all foods. No relief on change of diet. Complete relief for one year upon treating nasal condition, without operation.

In 1871 Voltolini (1), by removal of polypi from the nose of an adult asthmatic, relieved the asthma and also called the attention of the profession to nasal disease as a possible source of asthma. Mullin (2) has proved in animals that bacteria and India ink placed in the sinuses follow the lymph channels into the chest and to the peribronchial glands. Leyda (3) has recently suggested that many of the infected tonsils which are hastily removed have been infected directly from the diseased sinuses, the secretion being pressed into the tonsils each time the patient swallows. Dean (4) and Byfield (5) have repeatedly called attention to sinus disease in children. To quote Dean, "We believe that sinus disease is common in children of two years or over." These men have stressed the importance of sinus disease in children and especially the systemic effect of the localized infection. They have particularly spoken of the effect on the digestive tract.

[1]By the aid of the Selmene Winter Foundation. Read before the Radiological Society of North America, Nov. 29–Dec. 4, 1926.

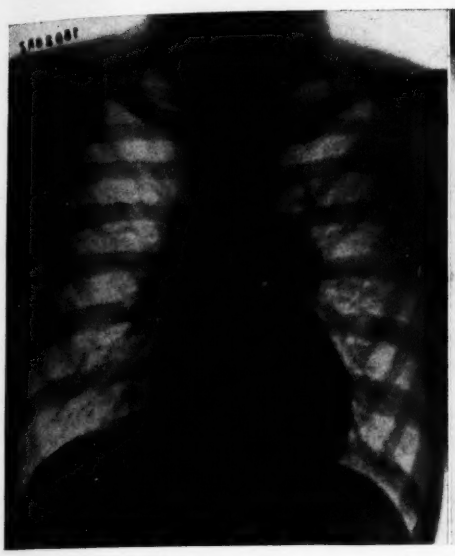


Fig. 1 *B*. Chest radiograph of case shown in Figure 1 *A*. Note typical root changes.

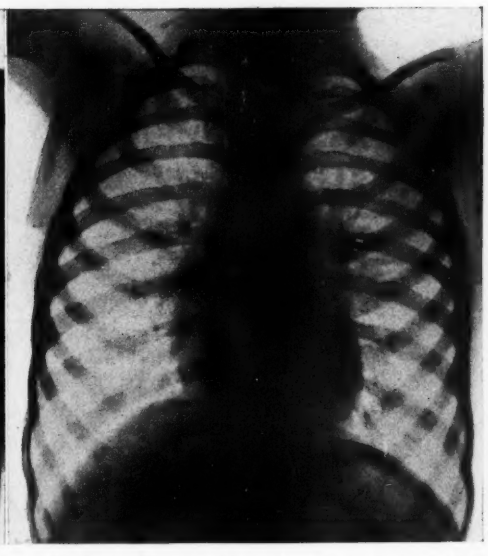


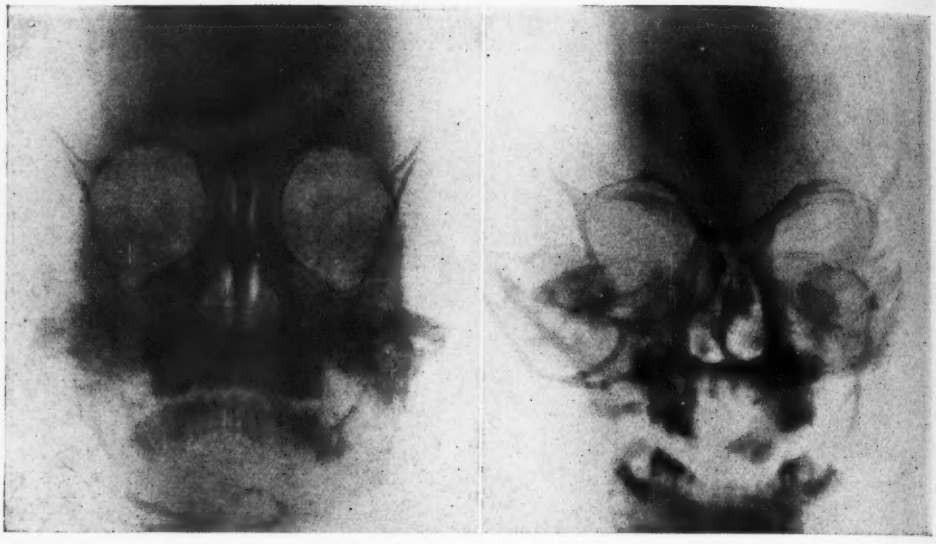
Fig. 2 *B*. Chest radiograph of case shown in Figure 2 *A*.

Wasson (6), in his excellent work on the developmental study of the child from birth to adolescence, finds that the mild snuffling cold of the small infant, not only is a sinus infection, but that this same infection produces pathology in the chest in almost every instance. This is easily demonstrable by the roentgen ray.

Mullin (7) states that bronchial infection in adults is usually in proportion to the amount of sinus involvement present, and the study of histories shows that the majority of them started with nasal trouble and cough in childhood. To quote Byfield (8), "It is our feeling when systemic disease is due to nasal infection, usually of the ethmoids. Surgical intervention is far more likely to cure or to produce at least greater relief in childhood than in adults." Lemere (9) states that "Cough, sometimes so persistent as to keep the parents up for nights in succession, and attacks of asthma in children, always suggest sinus infection."

When one stops to consider the damaging effect of a chronic cough or asthma in childhood and the likelihood of a long life of chronic invalidism, it would seem justifiable to investigate every possible etiology. In asthma, the protein sensitization has been a great help, but a large number of asthmatics are not relieved by changing foods or by desensitization, and the asthmatic bronchial case is benefited not at all.

The emphasis placed on desensitization has been more than the results justify. I cite two cases. A boy, aged 13, who for four years had had a chronic cough and frequent head colds, began having asthma. He was tested with all the proteins by two very able physicians of the Middle West. He was sensitive to practically all proteins and his asthma was not relieved by any measures at the physicians' disposal. He was sent to Colorado, where he does not have asthma, although he eats all the foods to which he reacted. He had infected sinuses and a chronic bronchitis. The sinuses were operated on, and after two weeks he returned to Iowa. In one week, he had severe asthma again. On returning to Colorado, he again was completely relieved, although indulging in all the foods

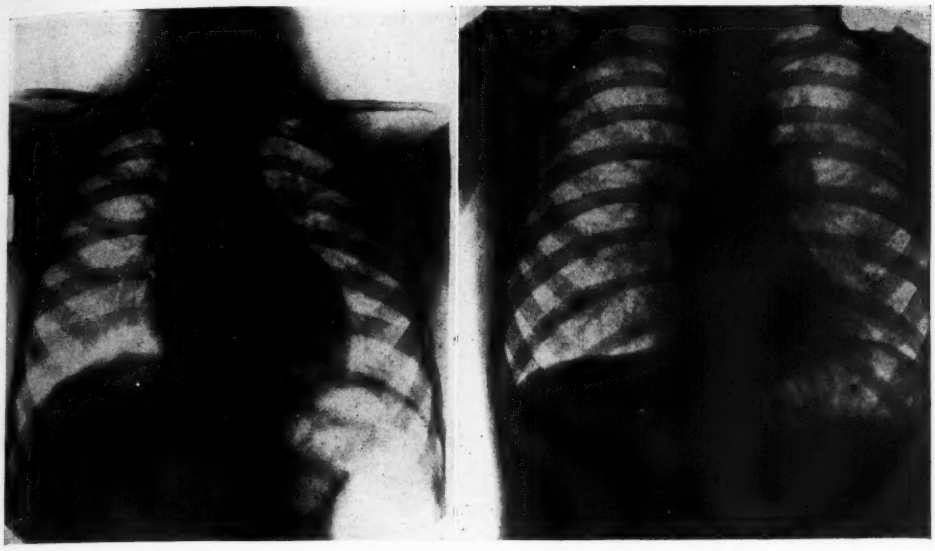


Figs. 3 *A* and 4 *A*. Sinuses of children 2½ and 3 years of age, respectively, showing infections which produce asthma in young children. Note all sinuses involved.

to which he was sensitive. The second case, a boy aged 4, son of a physician, has had asthma and bronchitis since the age of one year. He was tested at the Mayo Clinic, but did not react to any of the proteins. Two years later, I tested him and found he was sensitive to practically all foods which he was eating. He had asthma in the Middle West and also in Colorado. The adjustment of foods did not help. X-ray demonstrated sinus infection and infection around the bronchi. Treatment of the sinuses gave complete relief. X-ray examination, however, still shows infection through all sinuses and in the chest.

These cases raise the question of the relationship of sensitization to infection and the relationship of these, namely, sensitization and infection, to climatic conditions. In most of the work on asthma and sensitization in childhood, the sinuses have been overlooked. The reason for benefit by change of climate is an unsettled question: the fact remains that many cases are benefited by such a change. Most cases of asthma which gain relief through change of climate must needs seek a higher altitude rather than a lower. If they remove to a lower altitude, it must be a drier atmosphere and warmer than the one in which they previously lived. After such cases have gained relief, a few may return to their original climate, but the majority must remain in a relatively high, dry atmosphere. Whether the benefit is the result of atmospheric pressure on bacterial growth or the dryness of the air on the secretion of mucus, or both, is still open to debate.

The work of Wasson (6) with infants and their bronchial changes during mild acute respiratory infection, the papers of Mullin on the relation of infection in the upper respiratory tract to the lungs and bronchi, suggested the investigation of the sinuses in children suffering from asthma and bronchitis. So, in each case of asthmatic bronchitis or chronic bronchitis in a child, X-ray films were taken of both the sinuses and the chest. The results have been instructive and very helpful. The large majority, in fact, almost all, of the cases show evidence of sinus infection—seldom frank



Figs. 3 *B* and 4 *B*. Chest infections of cases shown in Figures 3 *A* and 4 *A*. Note typical changes about lung roots.

pus, usually thickening of the mucous membrane.

The lungs in such patients also give definite evidence of infection, particularly around the hilus. While the glands are increased in size, they are not discrete as in tuberculosis and the connective tissue and congestion is more diffuse, producing a conglomerate mass which tends to be rather closely limited to each hilus. The microscopic pathology of the asthmatic lung is difficult to obtain. The work of Koessler (10) is the most recent and reliable. To judge from his work, these cases probably have the infection mostly in the mucous membrane, and it has not invaded the deeper layers of the bronchi, as happens in the advanced adult case. Wasson is inclined to believe that the sinus infection plus such a chest infection gives a radiographic picture amounting to a typical syndrome of this type of respiratory infection.

This correlation of sinus infection, bronchitis, and asthma has been independently approached from three different angles, and the evidence is of such importance that it is difficult not to accept it. First, Mullin by animal experimentation has demonstrated the channels by which infection from the sinuses reaches the lungs and bronchi. Second, Wasson has proved, by roentgen-ray study, the close relationship between infected sinuses and infection in the lung. In fact, he has not found a case of bronchitis or asthmatic bronchitis in a child in which he has not been able to demonstrate upper respiratory infection, except in the tuberculous patient. Third, we have the clinical history of repeated head colds, each followed by bronchitis until the bronchitis becomes chronic, and in a certain percentage asthmatic symptoms are superimposed. When this condition is reached, each acute rhinitis is followed by bronchitis and asthma, the child often becoming so susceptible to infection that a new respiratory infection and asthma follow almost every trip outside the house. The patient rapidly becomes pale, anemic, and is ready for bronchial pneumonia or some other serious disease.

The treatment of these cases is difficult, for two reasons. First, the rhinologist is

slow to believe infection in the sinuses a factor. Second, the treatment of a child's sinuses presents many difficulties. Surgery is not always indicated, in fact, only occasionally, but local treatment to insure drainage is essential. General hygienic measures are of great benefit. The ultraviolet ray is particularly useful in supplying a substitute for the much-needed sunshine. A diet rich in vitamins is most important. Autogenous vaccines are of some benefit. The only drug which has a physiological basis for use and which seems to help is iodine, given in small doses over a long period of time. Asthmatic bronchitis cannot be cured during an acute attack of asthma. The greatest relief is obtained by treatment between the recurring attacks. When the above measures fail, a change to a high, warm, dry climate offers much greater benefit to the sick child than to the adult.

REFERENCES

(1) Voltolini: Quoted by T. W. Moore, Southern Med. Jour., XIX, 226.
(2) Mullin, W. V.: Jour. Am. Med. Assn., Sept. 4, 1926, LXXXVII, 739.
(3) Leyda, James H.: Colo. Med., January, 1927.
(4) Dean, L. W.: Ann. Otol., Rhinol. and Laryngol., 1918, XXVII, 534.
(5) Byfield, A. H.: Abt's Pediatrics, III, 778.
(6) Wasson, W. W.: Radiology, May, 1926.
(7) Mullin, W. V.: Ann. Otol., Rhinol. and Laryngol., September, 1921, XXX, 683.
(8) Byfield, A. H.: Jour. Am. Med. Assn., Aug. 17, 1918, LXXI, 511.
(9) Lemere, H. B.: Archiv. Pediat., XXXIX, 601.
(10) Koessler, K. K., and Hanke, M. T.: Archiv. Int. Med., December, 1922, XXX, 689.

THE ACTION OF X-RAYS ON THE ENDOCRINE GLANDS[1]

By HERMANN L. WINTZ, PH.D., M.D.,
Professor of Gynecology and Director of the Gynecological Clinic,
University of Erlangen, GERMANY

I

THE entire field of internal secretion offers, as yet, many questions for investigation, the solutions of which constitute many difficult problems. In experimental research the greatest difficulties arise from the fact that the glands of internal secretion exert an influence upon each other. For this reason, it seems impossible to treat of the function of an individual gland, or to isolate such a function experimentally; the changes that occur after the pathologic disturbance of a gland of internal secretion or after its complete cessation of function, are usually the result of compensatory influences of other glands. It is, therefore, permissible to refer the whole of the secondary phenomena to one gland only under definite conditions. The difficulty of isolating individual functions grows when we recognize that this action on other endocrine organs is not conveyed by way of the blood stream only; we know to-day that such an influence can be exerted also through the vegetative nervous system which regulates the secretion of glands in general. To speak, therefore, as we habitually do of the function of one endocrine gland, is justified only to the extent that we signify by that the predominant function of this gland, a function which cannot be replaced, or that, dependent upon the activity of this gland of internal secretion, certain definite secondary symptoms occur in the rest of the body.

It must be added that there is no absolute regularity for this mutual relation between endocrine glands. We know, for instance, that glands of internal secretion respond to definite physiologic and pathologic reactions of the body not only by definite functions but also by changes of their external morphology. Suppression of the ovarian action usually causes hypertrophy of the thyroid; in pregnancy there is also hypertrophy of the thyroid. On the other hand, it can always be found that this reaction will not occur in individuals in whom we have no suspicion whatsoever of an endocrine disturbance. At the same time, hypertrophy can occur in the same patient during one pregnancy, whereas in the next pregnancy the thyroid may remain entirely normal.

There are then not only individual variations causing differences between different persons, but it becomes apparent that there are also variations in the reactions which the same person shows at different times. The explanation of these actions and reactions, which seem so variable in different individuals and in the same individual at different times, was extremely difficult as long as the whole problem of internal secretion was regarded only from a purely physiological-chemical point of view. We know to-day that the vegetative nervous system has an intimate connection with the function of endocrine glands. The tonus of the sympathetic and parasympathetic nervous system is influenced by secretion of these glands, and, inversely, these nervous mechanisms frequently exert an influence on these glands.

However, these difficulties have not discouraged investigation. On the contrary, the time has come when clear recognition of these mutual relations builds the basis of a correct evaluation of experimental results.

[1]Presented before the Radiological Society of North America, at the Twelfth Annual Meeting, at Milwaukee, Wisconsin, Nov. 29–Dec. 4, 1926. Read by Dr. Rollin H. Stevens.

X-rays represent a valuable therapeutic procedure, useful not only for the treatment of endocrine disorders but especially for experimental investigation. This is possible, however, only when really exact methods of the measurement of X-ray doses (exact dosimetry) have been worked out, for it is necessary that the influence of X-rays on any endocrine gland can not only be precisely stated, but can always be repeated in exactly the same way.

There is one fact which has made X-rays so valuable in experimental investigation of the glands of internal secretion: this is, that most endocrine glands show a sensitiveness to the action of X-rays (radiosensitiveness) which is different in each gland. This radiosensitiveness changes according to the functional state of the gland and increases with increased action of the gland. One can examine this easily on glands with external secretion. The glandular tissue of the mamma in the resting stage is resistant to X-rays, so that a dosage of 105 per cent U.S.D. (unit skin doses) is necessary to cause shrinking. During lactation, on the other hand, 45 per cent U.S.D. is sufficient to inhibit the action of the cells. The most valuable factor with regard to the action of X-rays on endocrine glands is the fact that the individual cell-groups of a gland show different radiosensitiveness, and that it is, therefore, possible by the aid of X-rays to inhibit certain parts of endocrine glands, while others continue to function. Such a selective action has not been possible heretofore by any other procedure.

There are to-day a great number of valuable scientific investigations concerning the action of X-rays on endocrine glands. There is no need to review the results of the different authors as they are laid down in the literature, especially since this could not be done within the scope of this paper, and particularly since the trend of these investigations is familiar to you. For this reason I shall limit myself to my own experiences in this field.

Let me develop, first, a scale of those actions which are theoretically possible when exactly graduated X-ray quantities are applied to an endocrine gland.

1. *The total destruction of the gland.* For this, a correspondingly great X-ray quantity is necessary, assuming always, of course, that this quantity does not transgress the X-ray tolerance of the surrounding tissue.

2. *Temporary impairment to the whole of the glandular tissue of the respective gland, with a definite qualification that reparation is still possible.* For this there is needed, as a rule, a smaller X-ray quantity, which, however (and I want to emphasize this especially), must be more precisely defined than the X-ray quantity mentioned in the preceding paragraph (1), namely, the quantity necessary for the destruction of the whole gland.

3. *The complete destruction of highly sensitive cell-groups, with complete preservation of less sensitive cell-groups.* This is possible only in those glands in which there are present different parts of the gland or different cell-groups showing sufficiently large differences in radiosensitiveness. Again, it must be emphasized that the X-ray quantity must be defined with exactness in order to exert this selective action.

4. *The general increase of the activity of the cell; in other words, stimulation.* For this action the smallest quantities are necessary, but again in very exact doses. It will be seen that for the reactions enumerated in Paragraphs 1 to 4 there is not only a difference in the quantity of doses of X-ray, but that the ratio of exactness of dosage is different, being greater, for example, for stimulation than for complete destruction.

The question as to whether or not the stimulation to increased activity of cells is possible by means of X-rays is, as yet, un-

der discussion, and since there are very many different opinions expressed on this point, it seems important to me to state my own position briefly.

Only absorbed energy can exert action upon the cell. A destructive action of X-ray can occur only when the applied energy is so great that the atomic and molecular changes prohibit a continuation of the life of the cell.[2]

The cells can evidently withstand smaller X-ray quantities. I speak of this phenomenon as the reparative ability of the cell *(Erholungsfähigkeit)*. One can also understand that when small energy quantities are absorbed the corresponding changes in molecular arrangement are so slight that there is only a general increase and speeding-up of the vital processes of the cell. Similar reactions have been known for a long time with regard to light and heat. There is no reason why we should deny the same action when energy is applied in the form of absorbable X-ray, especially since the stimulating action of X-rays on the vital processes of the cells has often been observed. It is possible also that the increased radio-activity is caused by catabolic substances. But impairment may not, even in the slightest degree, occur in cells which are stimulated.

As a definite conclusion it can be stated that the foundation for the realization of these four possibilities must be a very exact dosimetry. For the destruction of the complete gland the dosage does not need to be confined within such narrow limits as for the other three possibilities. It is necessary, as in the irradiation of carcinoma, to have a minimum dosage, and not to transgress the X-ray tolerance of the surrounding tissue. The end-result will be the same whatever the difference in radiosensitiveness may be between the cell which is to be destroyed and the surrounding healthy tissue. For the goal, namely, the destruction of an endocrine gland, will be accomplished when a dosage is applied which fulfills no other condition but that it does not transgress the tolerance of the surrounding tissue. It is different, however, when the goal is to exert a selective action on any one part of a gland. In this case, namely, when one cell-group has to be preserved, the difference in X-ray tolerance between the cells which are to be destroyed and those which are to be preserved is far smaller than the difference in X-ray tolerance between a whole gland and the surrounding connective tissue.

It becomes clear that, when the difference in radiosensitiveness is very small and when only one part of the gland is to be destroyed with preservation of another part, the X-ray quantity must be measured with a special exactness. For now the dosage has to be clearly defined both as to its upper and its lower limits. For such an exact measurement of dosage it is not sufficient to measure merely the primary irradiation: for it is to be understood that the primary irradiation is changed a great deal both in quality and quantity on account of the transition through a more or less thick layer of tissue. The qualitative changes can be reduced to a minimum through a corresponding filtration of higher absorption and through a focal distance of more than 50 cm. The quantitative alteration, on the other hand, is dependent upon the additional dose of scattered radiation, and this, again, is dependent upon

---

[2]When roentgen rays impinge upon substance, the only elementary process we know exactly is the releasing of electrons. The atom is brought into a state of higher energy. If the atom returns into the lower state of energy, the result will be a secondary radiation (fluorescent radiation). Besides, when the atom collides with an electron or another atom, energy can be transformed without producing radiation (impacts of second kind — *Stoss zweiter Art*). According to the theory of quantum, the result will be kinetic energy (heat — *Warmebewegung*), or chemical action. The distribution of the effect of the radiation is, according to the same theory, regulated by the laws of probability. Hence with small intensity of radiation only a few molecules in the unit of volume are enriched in energy. There is a continual chemical transformation in the living tissue which becomes evident in cell activity. If by light irradiation, only a few molecules become excited and thus the chemical activity is increased, the living function of the cell is intensified (stimulation). If, on the other hand, with great intensity of radiation, a great number of molecules in the unit of volume or even the total of molecules of a cell is excited, one can understand that this great increase of energy surmounts the quantity bearable for life function. The result is a disturbance of function.

the volume dosage. This latter can be determined in most cases only by comparative experimental measurements.

The intensity of primary radiation is best determined by connecting an ionization chamber, casting no shadow, with a galvanometer during treatments. For the volume dose and the additional dose due to scattered radiation, the size of the irradiated object is of importance. This factor, whereby the final dose is increased or decreased, is of great consequence, especially if layers of less than 5 cm. thickness have to be irradiated and if there is no under-layer of at least 10 cm. beneath the organ to be treated. Also, when the under-layer is more than 10 cm., its influence on the dose need not be considered.

The factor under consideration, due to the presence of stray radiation, depends also on the size of the mass of tissue surrounding the object to be irradiated. A comparison between ovary and thyroid will show this most clearly. Let it be supposed that the same effective dose is to be administered to both organs. The apparatus and tube must first of all be so adjusted that the primary radiation in respect to wave length and intensity is the same in each case. Further, the different depths of ovary and thyroid lobe must be taken into consideration. But this alone does not suffice. It is necessary to consider also that there are other great differences between ovary and thyroid, and, further, that though the portal of entry may be the same size in each case, the cone of rays has to pass through a thicker layer of tissue to reach the ovary than to reach the thyroid. The ovary, therefore, receives an additional dose from the upper layer. Again, in the case of the ovary there is a considerable substratum which is lacking in the case of the thyroid, and, consequently, the backward scattered radiation is lacking also.

Thus, in spite of the same primary roentgen energy, the effective dose administered to an organ varies in quantity according to its position and other anatomical conditions. The absence or presence of an upper- or under-layer is also noticeable with regard to the quality of radiation effective in an organ. We know this from Compton's discovery. He found that the wave length of roentgen rays is increased by scattering to 0.024 Å.U. on an average; the alteration becoming more noticeable as the radiation becomes harder.

Furthermore, with deeply situated organs the effect of primary radiation is much less than that of secondary. This fact explains how it is possible that, with regard to biological effect, we have in deeply situated organs to deal with a softer radiation than with superficially situated organs, even if in both cases the average wave length of the primary radiation is the same. In respect to the extent of the biological effect, however, wave length plays an important part, for it is now an established fact that greater wave lengths, *i.e.*, soft radiation, are apt to produce a greater biological effect than hard radiation.

Another condition must be considered when radiating the ovary: the gas accumulation in the intestine. All our comparative measurements to establish the depth dose are performed in using an upper layer of water or wax. Hence, these measurements are correct with respect to the region of the portio vaginalis, the upper layer of which consists of the full, or perhaps empty, bladder. The values obtained by measurements can be put in correlation with the ovary only when the intestine is empty, especially if it is free from gas; if not, in case the bowels are filled with air, absorption is less, but at the same time there is markedly less scattered radiation. The focus-skin distance may also undergo an alteration if part of the intestine is filled with air.

From this it unquestionably results that

the difference between the various irradiations becomes still greater and that exact measurement is rendered still more difficult when small layers of tissue are irradiated using small portals of entry, as is the case with animals.

It would lead us too far, were we to attempt to examine the very interesting discoveries we have made by exact dosage measurement on animals. From what I have already said, however, it is clear that it is impossible to estimate by comparison the dose which actually reaches an organ without taking into consideration all these points. For the exact scientific irradiation of the endocrine glands, however, the dose must be known and must be reproduceable.

The difficulties I have described are most easily overcome with the ovary, for in this case it is possible to work on experimental lines, *i.e.*, under conditions which permit of comparative measurements and the exact reproduction of a dose. The description of this method of irradiation is reserved for a detailed publication. For what follows it suffices to give some brief indications concerning the unit of measurement required.

In such indications I refer to the U.S.D. (unit skin dose). The dose is defined as follows: That quantity of radiation of medium wave length (approximately 0.16 Å.U.) produced at a distance of 23 cm., which, with a port of entry 6×8 cm., causes after eight to ten days a slight reddening and after four to six weeks a faint tanning of the skin. This indication is intended to give only an idea of the biological effect; in reality, the conception, "unit skin dose," is a physical measurement, for it corresponds to an average value.

It is claimed for this value that, according to the experience gained in several thousand cases, it produces the above described biological reaction. This standard value is determined by means of a calibrated iontoquantimeter.

During recent years in Germany, it has become customary to take an absolute measure, the unit R, as the standard measure of X-rays. Behnken defines this unit as follows: "The absolute unit of the roentgen-ray dose is obtained from that roentgen-ray energy, which, by fully utilizing the secondary electrons and by avoiding secondary radiation from the wall of the chamber, produces in one cubic centimeter of atmospheric air under normal conditions such a degree of conductivity that the quantity of electricity measured by saturation current equals one electrostatic unit."

Referring the U.S.D. to that unit, one obtains 500 R for the primary radiation. This value of 500 R is obtained in atmospheric air, not on the skin, because the backward scattered radiation from the tissue below would produce an additional dose, which would mean an increase in the quantity of radiation. As the biological effect of soft radiation is greater, it is necessary to keep to an average wave length of about 0.16 Å.U.

Depth doses cannot be indicated in terms of R because it would be necessary to take into account the altered conditions due to scattering. For this reason I usually measure depth doses in percentages of the U.S.D., because in this way an idea of the biological effect is conveyed, and, at the same time, we start from those factors which determine the U.S.D. The depth of the organ to be radiated is taken as 10 cm.; further, it is necessary that beneath the base of the cone there should be another layer of 10 cm. and that, in consideration of backward-scattered radiation the whole block measures $20 \times 20 \times 20$ cm. Depth doses measured under these conditions are expressed in percentages of the U.S.D.

When measuring the total effect in the body the volume dose is decisive, giving as it does the volume of the body on which roentgen rays impinge directly. We have

here taken as the unit of volume a cone of rays having a surface base of 6×8 cm., its apex being the focus at a distance of 23 cm., and which passes through a tissue layer of a thickness of 10 cm., thus having in the depth a base of 9×12 cm.

By graduating the X-ray doses acting upon the ovary, different biological effects are obtained: total sterilization, permanent amenorrhea, temporary sterilization; for the various parts of the ovary have a different sensitiveness to roentgen rays.

These different biological effects were found more or less by chance. But to-day, by systematically examining the sensitiveness of the cells and by exact dosage, taking into consideration all factors which exercise an influence upon roentgen radiation, a solid foundation has been established. We know not only the clinical results dependent upon dosage but also the changes produced in the ovary.

Total sterilization naturally interferes strongly with the ovarian function. It equals surgical removal. By a dose of 45 per cent of the U.S.D. all the endocrine parts of the ovary are destroyed, only the ovarian connective tissue remaining as a scar. But having administered a dose of 34 per cent of the U.S.D. one can find that some of the concomitant phenomena of the total castration are either lacking altogether, or become evident to a slight degree in a few cases only.

One can see that there are neither vasomotor symptoms of the same intensity nor alteration of metabolism so frequent with castration. The histological picture shows the following stages (even by further division of doses, no clearly defined histological stages can be produced):

1. The whole germinative part is destroyed, while that group of cells with endocrine function which originates from the theca is left intact.

2. Besides, there are only atretic or severely injured follicles; neither ovulation nor the formation of corpus luteum is any more possible.

If, on the contrary, a dose of 28 per cent of the U.S.D. is applied, so-called temporary sterilization is obtained. After the irradiation, menstruation occurs once or twice, sometimes three times; it then ceases for from 1 to 3 years. After this time it occurs again regularly. The ovula, growing then, are not checked in their development and pregnancy may occur, with the result of a normal child. The possibility of such a roentgen amenorrhea is easily comprehensible if one assumes that primordial follicles show less sensitiveness than growing follicles. This is supported by the fact, gained from experience and generally valid, that cells in rest with a minimum metabolism, as is the case with the cells of the primordial follicle, are less sensitive to radiation. This explains how it is possible that menstruation can occur again later on, but it does not explain why, after having applied the dose of 28 per cent of the U.S.D., menstruation will still occur several times.

Further examinations were necessary to explain these relationships.

In the first place, purely clinical observations of the occurrence of genuine menstruation after X-ray treatment can be mentioned. It was possible to determine that the type of menstruation was dependent upon the time at which X-rays were applied. If, with normally menstruating women, the dose of 34 per cent of the U.S.D. (sterilization dose) was administered shortly after menstruation, menstruation did not occur again. This result was always obtained when X-rays were applied not later than twelve days after the menstrual period—dated from the first day of the last menstruation. After this time the result obtained was irregular: until the seventeenth day in about 50 per cent of the

cases, one could observe that the next menstruation did not occur; but the more the irradiation approaches the time of the next menstruation period, the higher is the proportion of cases in which the next menstruation occurs once more. On and after the twenty-second day, thus in the last week before the expected period, a dose of 34 per cent of the U.S.D. cannot suppress the next menstruation; but the next one after that will not occur.

This observation is easily explained by the development of the corpus luteum. We know that the graafian follicle from about the twelfth to the fourteenth day—dated from the first day of the preceding menstruation—is mature, and bursts. The formation of the corpus luteum follows immediately: in its first, or proliferative stage, the membrana granulosa of the graafian follicle is transformed into the secretion layer of the corpus luteum, and, about two days after, the cells begin to secrete. Thus into the blood stream is poured an internal secretion which produces the transformation of the mucous membrane of the uterus into its pre-gravid stage. This secretory stage lasts until about the twenty-third day, when the accumulation of lipoid begins in the cells. At this period sets in the secretion of those substances which are important with regard to the cause of menstruation and to the restitution of the mucous membrane of the uterus. This transformation into the lipoid stage does not occur when the ovum is fertilized.

Thus it is clear that roentgen rays impinging upon the ovary have an inhibitory effect upon the next menstrual blood flow only in so far as the graafian follicle is disturbed in its development, or as the secretion of the proliferative corpus luteum is inhibited.

When 34 per cent of the U.S.D. is applied to the graafian follicle the yellow body cannot grow. Hence, when the irradiation takes place in the first part of the intermenstruum, the next menstruation does not occur.

If a dose of 34 per cent of the U.S.D. is administered to the corpus luteum proliferativum, the menstrual period occurs once more in about half of the cases. This proves that the corpus luteum proliferativum has a somewhat lesser sensitiveness to roentgen rays than the follicle, for otherwise the irradiation given between the twelfth and seventeenth day ought to bring about the suppression of the next menstruation.

If, after an irradiation after the twenty-second day, the next menstruation in all cases occurs once more, this is explained by the fact that the substances producing the pre-gravid stage are already circulating in the blood. These menstrual periods, however, are mostly prolonged and increased, not only on account of hyperemia of the uterus and of its mucous membrane, but because the internal secretion of the corpus luteum, the lipoid secretion by which the termination of menstruation is regulated, has undergone the influence of roentgen rays. Since, however, prolongation and increase of menstruation was not very marked, and did not occur in all cases, one may assume that the roentgen sensitiveness of the corpus luteum lipoidare is less than that of the proliferative yellow body.

The histological examination of the corpora lutea irradiated during the various stages of its growth perfectly agrees with the clinical picture. Hence, one may state the following with respect to the differences of sensitiveness:

The corpus luteum is in general less radiosensitive than the graafian follicle and its predecessors. The greatest radiosensitiveness is shown by the proliferative corpus luteum, then follows the secretory stage, further the lipoid stage, and finally the obliterating stage.

After the application of 28 per cent of the U.S.D. one to two menstruations occur, even though the irradiation has been given a short time after menstruation. From this fact it follows that the application of the dose reduced to 28 per cent exhibits another difference of sensitiveness, namely, in the follicle. I have already pointed out that the occurrence of several menstrual periods after the irradiation cannot be explained by the assumption prevailing up to now, that there is, from the primordial follicle up to the ripe graafian follicle, a gradually increasing sensitiveness to roentgen rays.

One is rather forced to assume that the pre-stages of the graafian follicle must have a higher sensitiveness than the mature graafian follicle. It is quite certain that by applying 34 per cent of the U.S.D. the transformation of the ripe graafian follicle into the yellow body is inhibited and that the next menstruation is suppressed.

This disturbance does not occur, however, when 28 per cent of the U.S.D. is administered, and that is the reason for the occurrence of the next menstruation. The same occurs when, shortly before the menstruation, a dose of 28 per cent of the U.S.D. is applied. The next menstrual period will occur in any case, the one after the next also, because the ripening follicle, which was in the developmental stage at the time of irradiation, has not been injured. Further menstruations do not occur because the stage of development preceding the graafian follicle, evidently the most sensitive, is destroyed by the dose of 28 per cent of the U.S.D.

Histologically this pre-stage shows extremely abundant proliferation of the membrana granulosa. This is a state of rapid karyokinesis: many mitoses are seen in the cells, even the internal theca offers a picture of rapid growth. At this time the cells become bigger, they partly show an epitheloid character, and the theca as such is more prominent.

The rapid growth of the whole follicle, beginning in the pre-stage, continues until the graafian follicle is mature and bursts: in the last stage, however, the whole process is no longer as rapid as in the preceding stages. Secretion is now the principal function of the cell.

The assumption that the pre-stage of the graafian follicle shows a higher radiosensitiveness than the primordial follicle and the mature graafian follicle, also agrees with our experience as to the radiosensitiveness of other cells in different stages. The resting cell is always less radiosensitive than the growing one, and functioning cells are also less sensitive than proliferative ones.

With cancer cells I have shown, by exact measurements, that the difference of radiosensitiveness between the resting cell and the karyokinetic cell is about 30 per cent; in the first instance, 105 per cent of the U.S.D. is required for the destruction of the cell, whereas, in the second instance, 70 per cent is necessary.

The radiosensitiveness of the pre-formed cancer cell (epithelium cell destined to be transformed into a cancer cell) exceeds 120 per cent of the U.S.D.

Thus we have the same differences of sensitiveness in both cell types; hence, it is comprehensible that the membrana granulosa of the pre-stage, which is in rapid karyokinesis, is sensitive to a smaller roentgen dose than the mature graafian follicle.

As to the radiosensitiveness of the ovum, the histological sections permit further conclusions. They show that, irradiation having been given on the twelfth day dating from the first day of the last menstruation, the ovum is destroyed, but not the membrana granulosa. Examining systematically the injuries which have been produced in the ovum, one may state that the radiosensitiveness of the ovum is dependent on that of the

follicle in such a way that the ovum, too, is the most sensitive during the proliferative stage of the follicle. This results from the fact that the ovum is dependent for its nutrition upon the granulosa.

The ovum, as such, in all its stages, is more sensitive to roentgen rays than the granulosa. The ovum, however, detached from the granulosa and proceeding towards the uterus, is, evidently on account of the lacking tissue connection, markedly less sensitive. Thus it is possible that ova which were still in the fallopian tube during the application of the sterilizing dose, may be fertilized. This relative unsensitiveness of the detached ova is shown by the fact that there is progeny resulting from such ova which, nevertheless, shows no abnormalities.

These observations show that the sensitiveness of follicle and ovum run parallel, but that the ovum always has a somewhat higher sensitiveness than the follicle and its granulosa epithelium. Corresponding with the growth of the follicle, the radiosensitiveness of the ovum increases from the primordial follicle and is highest in the prestage, which I have described, exactly in the same way as the follicle. When the follicle has matured and has become the fully developed graafian follicle, its sensitiveness decreases just as the sensitiveness of the ovum. Only at the moment of expulsion, the ovum, having become an isolated cell, is markedly less sensitive.

While roentgen amenorrhea is persisting, the function of the endocrine cells of the ovary is by no means inhibited; for the follicular cell complex is injured only to the extent that the growth of the graafian follicle cannot set in. Hence, the growing primordial follicles are checked in their development and become corpora atretica. Such a process is not specific for the action of X-rays, for the ovaries of women not exposed to X-rays also contain corpora atretica. If a growing follicle shows an injury which checks the perfect formation of the graafian follicle, that kind of degeneration which we call atresia sets in. By irradiation, however, a relatively great number of follicles are injured in their early stages: thus it is not astonishing that the ovary of women to whom the dose of temporary sterilization has been applied, contains an unusually great number of corpora atretica: on the other hand, the ovaries of these women show neither a mature graafian follicle nor a corpus luteum.

The corpora atretica take over part of the endocrine function of the ovary: one may suppose that they replace the corpus luteum, especially with regard to its action upon the whole female body. That the secretion of the corpus atreticum is not identical with that of the corpus luteum is shown by the fact that in spite of a great number of corpora atretica, neither pre-menstrual hyperemia of the uterus nor menstruation can be produced.

Besides these corpora atretica, in the histological section of the ovaries, one finds distributed over the stroma, big cells with globe-shaped nuclei and protoplasma rich in lipoids, which are sometimes arranged in the vicinity of blood vessels. According to Wallart, Seitz and others, one has designated this cell complex as "interstitial gland." However, I do not think it correct to look upon them as independent organs, for, according to their derivation, they are cells from the theca folliculi: they are either formed from connective tissue cells, scattered in the stroma, just as the theca lutein cells in the corpus atreticum, or they are remnants of obliterated corpora atretica. For this reason these cells can produce only the same kind of secretion as the corpora atretica, if one may ascribe any active secretion to them at all.

The assumption that the corpora atretica take over part of the internal secretion of the corpora lutea is supported by the ab-

sence of deficiency symptoms with cases of roentgen amenorrhea. Histological examination of such ovaries actually has proved a massed occurrence of corpora atretica; but if the dose of 45 per cent of the U.S.D., *i.e.*, the dose of total sterilization, has been applied, no more corpora atretica are found in the ovary when a certain time has elapsed, and, correspondingly, deficiency symptoms are strong.

This difference corresponds with the clinical picture, for, whereas, after total destruction of the ovary—by surgical, as well as roentgenological measures—about 80 per cent of the women suffer from severe deficiency symptoms, only about 28 to 35 per cent of the patients, to whom 34 per cent of the U.S.D. has been administered, complain of severe symptoms.

This shows that with a dose of 34 per cent of the U.S.D., from which results a permanent amenorrhea, not all parts of the ovary which produce secretions are destroyed, for the frequency, as well as the intensity of the deficiency symptoms, are in no proportion to the observations made after total sterilization.

After application of the temporary sterilization dose of 28 per cent of the U.S.D., deficiency symptoms occur in very few cases only, while amenorrhea is persisting: some patients have a sensation of hot flashes.

It seems interesting to determine also why, with patients to whom only 28 per cent of the U.S.D. has been applied, deficiency symptoms occur at all. One could assume that this is possible only when there are endocrine disturbances. The possibility of dosimetric mistakes may be excluded in these cases which were irradiated according to exact measurement.

This was cleared up by microscopic examinations. The ovaries of women suffering from severe deficiency symptoms after having been irradiated with a dose of 28 per cent of the U.S.D., showed so-called small-cystic degeneration. This depends on the "disposition" of the ovary: for we also observe ovaries with small-cystic degeneration which have not been treated by X-rays.

This "disposition" may also be conditioned by the disorder of another endocrine gland. Through irradiation, the cells of the membrana granulosa are more injured with respect to their proliferative than to their secretory function. By the fluid secreted, however, the cells producing secretion are compressed. But as the primordial follicles are not destroyed by a dose of 28 per cent of the U.S.D., a slight stimulus is often sufficient to compensate this small-cystic degeneration. Therefore, patients suffering from severe deficiency symptoms during temporary amenorrhea produced by roentgen rays, react to "stimulative" irradiation with small doses (about 3 to 5 per cent of the U.S.D.) or to stimulation by diathermy. They also respond well to endocrine preparations—Agomensin, for instance—and even to unspecific protein preparations such as serum or casein.

Other patients even before the irradiation showed a certain reactivity of the vegetative nervous system which has proved to be decisive with regard to the severity of the castration symptoms in general. For this reason, the individual vegetative constitution must be seriously considered with regard to modern roentgen therapy.

Examination of metabolism shows also that great differences exist between total sterilization, permanent roentgen amenorrhea (exovulation), and temporary sterilization.

It was found by determination of the basal metabolism that, after surgical castration, basal metabolism was reduced in all cases—about 18 per cent in the average. With permanent roentgen amenorrhea, obtained by application of 34 per cent of the U.S.D. in one sitting, basal metabolism was reduced in about 65 per cent of the cases,

but only about 10 to 12 per cent in the average. With cases of temporary roentgen sterilization, however, basal metabolism was not reduced in any one case.

Similar differences were also established by examining the specific dynamic action, which was especially reduced in the majority of surgically sterilized cases. With patients to whom a dose of 34 per cent of the U.S.D. had been applied, the specific dynamic action was reduced in very few cases, and after temporary sterilization in no case.

II

It is an unavoidable consequence of the well-known close co-operation of the various endocrine glands that, if the function of the ovaries be totally or temporarily depressed or at least disturbed, the functions of other glands with internal secretion become involved. In the same way, owing to a disturbance of other glands, the function of the ovary will be influenced. The best clinical and experimental work available at this date concerns the interrelationship existing between ovary, thyroid, and pituitary; the thymus also exhibits certain reciprocal actions.

Let me first of all refer to the visible enlargement of the thyroid which occurs in a great many girls during the age of puberty; the relationship between the pituitary and the genital organs is clinically evident by dystrophia adiposogenitalis, though this has not yet been adequately explained. Hyperplasia and also malignant enlargement of the thymus are generally accompanied by amenorrhea. But we are still far from being able to establish definite rules concerning the co-operation of the glands of internal secretion. I desire, therefore, to confine myself to the review of individual cases which I have personally observed, in so far as they can be considered typical of the interrelationship existing between the endocrine glands in various diseases.

OVARY AND THYROID

The literature published in various countries of the world over by prominent radiologists (among others, Pfahler, Jenkinson, Stevens, Soiland, Barclay, Lars Edling, Fischer, and Sielmann) concerning the treatment of Basedow's disease, and supported by extensive statistics, gives evidence of the best results only. The percentage of cures obtained in all cases varying between slight thyrotoxicosis and pronounced Basedow's disease, ranges between 70 and 85. These results and the personal experience of almost all radiologists seem to prove that the X-ray treatment of Basedow's disease is justified.

I can recount only briefly my personal experience with the X-ray treatment of Basedow's disease, upon which I was able to report for the first time at the congress of the German Society of Naturalists and Physicians at Nauheim in 1920, because that would lead too far outside of the province of this paper. I consider it necessary, however, to say a few words about the technic I employ in irradiating the thyroid, especially because, with individual variations of the dose, this method is also used for cases of hyperthyroidism resulting from the interrelationship with other organs.

I consider the irradiation of the thyroid to be only a part of the whole treatment, though a most important one. If, upon close examination of the patient, even a suspicion exists that the thymus may be involved, this gland is also irradiated. The thyroid and thymus may be irradiated through a single field, or the area divided into two smaller fields. If the larynx has to be specially protected, the fields are arranged in such a way that the lateral lobes of the thyroid are reached by the cone of rays directed obliquely towards the outside.

By adequate protection, a shadow, enlarging in the directions of its depth, is produced in the mid-region. The initial dose

administered to the whole thyroid gland amounts to from 50 to 60 per cent; to the thymus from 55 to 65 per cent is administered. This dose is, under no circumstances, repeated before an interval of six or seven months has elapsed since the first treatment and not more than two of such doses may be given. As supporting treatment, residence in moderate or higher altitudes or simply a change of place is advised, according to the needs of the individual case. In instances of greatly increased basal metabolism and correspondingly increased specific dynamic action arsenic is prescribed, with a view to reducing the metabolism. The curative results obtained equal those of the statistics above mentioned and are about 80 per cent. I realize that a comparison of these statistics is not relevant because the result obtained is decisively influenced by the quality of the cases treated.

(A) Thyroid Dysfunction of the Ovary.—In this classification, I wish to mention cases wherein the dysfunction of the ovary may be supposed to result in consequence of hypersecretion of the thyroid. I have now observed a representative number of these cases. The dysfunction of the ovary in these instances manifests itself by prolonged and increased menstruation, but sometimes is characterized by dysmenorrhea. Naturally, a connection with the thyroid may be assumed only if symptoms of hyperthyroidism actually exist, for by far the greater part of these cases of ovarian dysfunction producing excessive menstruation are of purely ovarian origin and cannot be readily explained by a disturbance of the normal development of the corpus luteum. The purely ovarian cases generally react to ovarian treatment. Sistomensin (Ciba) hypodermically has proved especially excellent.

Those cases, however, which did not respond to ovarian therapy showed typical deviations in metabolism. I was able to examine systematically 16 of these cases with regard to their gas metabolism. Fourteen of them showed increased basal metabolism as well as increased specific dynamic action. It seems justifiable to assume that these patients suffer from latent hyperthyroidism, as the alteration in metabolism cannot be explained by other influences, and, besides, certain clinical symptoms point to thyroid involvement. In the assumption that the thyroid is involved, I find an explanation of the unsatisfactory response of these cases to the customary treatment with ovarian preparations. Therefore, when continued treatment with Sistomensin and other ovarian preparations was unsuccessful, X-ray treatment of the thyroid was resorted to in seven cases by applying a dose of 40 per cent of the H.E.D. to the thyroid and thymus, using a single portal of entry. The treatment was completely successful. The profuse bleeding, lasting ten days and recurring every three weeks, was gradually, in the course of several months and with no other treatment, changed into normal menstrual periods beginning every twenty-eighth day. From this time on the gas metabolism as well as the specific dynamic action showed normal values.

(B) Ovarian Hyperthyroidism.—In contrast with those cases, characterized by thyroid dysfunction of the ovary, another group of diseases is to be considered in which ovarian disturbance is the primary factor. We recognize these as ovarian hyperthyroidism. These cases develop essentially through a long and continued disturbance of the ovarian function; chronic inflammatory changes, pelvic peritonitis, salpingitis, oöphoritis, may be mentioned as examples. Here, around the ovary and even involving its stroma, an inflammatory process develops, which produces a small-celled infiltration of the ovary and pronounced hyperemia. It is comprehensible that the growth of follicles and the formation of corpus luteum can be disturbed to a

considerable extent by this inflammation. The adhesion of the ovary to its surroundings may cause a compression in space, which decidedly interferes with the normal development of the follicles and the development of the corpus luteum. Disturbance of menstruation either in the form of prolonged or increased menstruation or as amenorrhea caused by inflammatory disease is the well recognized result of this condition. As a rule, during the course of the inflammatory stages, polymenorrhea is of frequent occurrence, whereas amenorrhea is present in the stage of adhesion and shrinking. There may be amenorrhea in the inflammatory stage also, as these two forms of endocrine disturbance may alternate. Their occurrence depends often on the intensity of the treatment, which should be conservative, and usually restricted to the application of heat by various methods. More radical treatment, as, for instance, injections of foreign protein or organic preparations applied for controlling the flow of blood, may more quickly reveal endocrine disturbances.

Once these ovarian disturbances have appeared, hyperthyroidism begins to develop gradually. Only those patients who in childhood, during the age of puberty, and during former pregnancies had no symptoms of hyperthyroidism, pertain to this classification and are referred to in this connection. I had also opportunity to observe patients in whom formerly, for various other reasons, exact examinations of the metabolism had been conducted, and who at this time exhibited no increased combustion or other symptoms of hyperthyroidism. Endocrine disturbance having begun, these patients now showed increased basal metabolism as well as increased specific dynamic action. To this group belong, as well, those cases of hyperthyroidism which developed following the existence of a myoma over a considerable period. Assuming a dysfunction of the ovary as the cause of myoma, the inclusion of these cases in the present classification seems justified.

On the contrary, I would not regard as belonging under this heading cases of Basedow's disease or of hyperthyroidism occurring after pregnancy or during the puerperium, for in these instances, as in cases of Basedow's disease generally, the reduction of organic resistance as a whole plays an important part. The continuance of the pregnancy may also be accepted as a causative factor.

X-ray treatment of the thyroid need not be considered in connection with the treatment of ovarian hyperthyroidism, for this condition is only a temporary manifestation of the thyroid which, furthermore, has its origin in the ovary. It is ill-advised to prescribe ovarian preparations in these cases, because the disturbance is not caused by the endocrine cells themselves, these being retarded in the course of their development and transformation. Thus it may be stated that evidently by purely mechanical disturbances, cystic degeneration of a corpus atreticum and a corpus luteum occurs during the transitory stage and a cyst of the corpus luteum is formed. We know that this cyst can inhibit the further development of the graafian follicle. Ovarian preparations, however, so far as they are able to produce a real hormone action, only intensify the confusion in the endocrine activity.

It seems, therefore, entirely justifiable to bring about the temporary depression of the ovarian function and to administer the dose necessary for temporary sterilization.

Clinical observations of a sufficient number of cases have been made and in none of these cases has temporary sterilization done any harm. On the other hand, I was able to observe that, following the amenorrhea produced by X-rays, the symptoms caused by hyperfunction of the thyroid slowly disappeared. While the X-ray amenorrhea ex-

isted, the inflammatory condition of the adnexa was made to retrogress by continued conservative treatment given during this period and after two to three years the amenorrhea ceased and menstruation recommenced, while the thyroidism did not recur.

It is difficult to give an accurate physiological and anatomical explanation of these phenomena. I assume that in consequence of spatial compression and inflammation the previously healthy endocrine cells of the ovary now produce secretions which exert a stimulative effect upon the thyroid. If the ovarian function is depressed by roentgen rays, the pathological secretion of follicle and corpus luteum ceases and with it the stimulative effect upon the thyroid. Temporary sterilization in itself, performed on a healthy woman, according to the observations made up to now on this point, does not affect the thyroid; at any rate, I have never observed a case where hyperthyroidism was excited by temporary sterilization. Neither has, in general, the application of the dose producing permanent inhibition of the ovarian function any unfavorable influence upon the occurrence of thyrotoxicosis or Basedow's disease.

(C) Amenorrhea and Polymenorrhea Caused by Hypothyroidism. — The best known form of thyroid hypofunction is myxedema; the frequency of its occurrence and its gravity vary greatly in different countries. In this connection, however, as in dealing with hyperfunction of the thyroid, I will discuss only the less pronounced forms of hypothyroidism. Just as there is a moderate form *(forme fruste)* of Basedow's disease, there are also similar forms of myxedema known, which agree only in respect to a few symptoms with the usual syndrome of myxedema. E. Hertoghe was the first to point out these conditions and he has designated this disease as "hypothyreoidismus chronicus benignus." Meanwhile, various observers have shown that many a case of chronic functional obstipation is etiologically traceable to hypothyroidism.

Thus, G. Strauss, G. Deutsch, and A. Oswald have obtained excellent results by administering thyroid tablets in cases in which obstipation would not yield to other measures.

In X-ray therapy, cases producing ovarian disturbances are of primary interest. Hypofunction of the ovary in general is typical of the symptom complex that myxedema exhibits. With the pronounced cases of this disease, as after removal of the thyroid, one finds severe degrees of genital atrophy which becomes evident by amenorrhea.

With the lesser forms of hypothyroidism, however, increased monthly discharge is more frequent. But this should not be interpreted to constitute hyperfunction of the ovary. I have observed cases of increased regular menstrual blood flow, which, when closely investigated, showed typical symptoms of hypothyroidism. In such patients reduced basal metabolism and a tendency to adiposity was invariably demonstrable. The specific dynamic action was scarcely altered in these cases. Among further symptoms, the dry and hard skin was especially evident, also the tendency to liquid-retention. A distinct change in the genital organs could not, by examination, be discerned in most cases. Two patients had hypoplastic genitals.

Experience has shown that thyroid preparations must be administered to these cases. The irradiation of the ovaries in order to repress the monthly discharge is etiologically wrong and harmful to the patient, because hypofunction of the ovary, by depression of the ovarian function, is further aggravated. The thyroid function in healthy persons as well is reduced.

Attempts made to stimulate the thyroid by small doses of X-ray were of no use. On

the other hand, the thyroid preparation "Inkretan" was very resultful in these patients. The tendency to water-retention, as well as the fat deposits, disappeared. The most important thing, however, was that the intensive blood flow, which before could not be controlled either by ovarian preparations or styptics, assumed the character of a normal menstruation.

In two cases I was able to study the processes going on in the ovary. Although two cases cannot be considered conclusive, the findings appear sufficiently important to be mentioned here, as in both cases a bilateral small-cystic degeneration of the ovaries was found. If the aspect of symptoms of polymenorrhea in connection with hyperthyroidism are taken into consideration, one finds that these cases are really not rare. The patients I observed were mostly nulliparæ, about 30 years of age, the youngest being 25 years old. Though in the course of the last year I have paid special attention to this syndrome, I could not establish the identity of such a case in puberty. All dysfunctions observed at this period, in relation to the thyroid, belonged to the hyperfunctional group. It seems especially important to observe carefully the syndrome—polymenorrhea with hypothyroidism; and as these cases do not respond to local measures, such as ovarian preparations, curettage or diathermy, X-ray treatment of the ovary is generally considered to be indicated. It is, however, clearly evident from the etiology of the disease that the further reduction of ovarian function is altogether ill-advised.

Amenorrhea, recognized as an accompaniment of the graver degrees of hypothyroidism, is rare with the *forme fruste* of this disease, at least so far as I have been able to judge. Besides, precise diagnostic characteristics can scarcely be set down in this connection, as all the phenomena which accompany a milder form of hypothyroidism may be caused by primary hypofunction of the ovary, as well as by a pituitary disease.

In view of my experience up to the present, I would recommend the grouping with hypothyroid amenorrhea of only such cases as, besides the general symptoms of deposits of fat, water-retention, edema, dry skin, obstipation, have a specific dynamic action with values within the normal limits even though the basal metabolism is reduced. But if the specific dynamic action is markedly reduced, one should, according to R. Plaut, assume that a joint involvement of the pituitary prevails. Further experiences will show whether or not we can go on building up on this foundation.

Clinical observation made it evident that these cases of specific amenorrhea did not respond to the local treatment of the ovaries or of the uterus alone. Specific organic preparations, such as Agomensin (Ciba) or Ovowop, were unavailing, as well as stimulative X-ray therapy or diathermic stimulation. On the other hand, I could induce a regularly occurring, though weak, menstrual period by administering thyroid preparations, Inkretan, applied by itself or combined with Agomensin (Ciba). After having stopped this Inkretan-Agomensin therapy, the menstruation continued for about six months, but ceased again after this interval had elapsed, and the syndrome, present before the treatment, again appeared.

Thus in these cases organotherapy had a substitution effect; but it has not induced regeneration of the hypofunctioning glands.

(D) Pituitary Gland and Ovary.—The interrelationship between the endocrine function of the pituitary and the ovary is as well known as that existing between the pituitary and the thyroid. Thus we can, in the cases of a great number of pregnant women, find slight symptoms of hyperfunction of the pituitary gland. Here I mention only enlargement of nose, ears, lips and formation of exostoses. Histological ex-

amination shows a typical alteration of the pituitary body of the pregnant woman.

Of special interest to the roentgenologist is the observation that, with latent forms of hyperfunction of the pituitary gland, prolonged and increased menstruation occurs, which, like the climacteric blood flow, tends to assume a metrorrhagic character. Because, by sterilization, where the pituitary gland is normal, a histological alteration, similar to that existing during pregnancy, occurs in the majority of cases, one must avoid in such cases the administration of a dose inducing complete sterilization.

Two patients are under my observation, who suffered from a disease which may be designated as hyperpituitarism, as they show clinical symptoms of slight acromegalic alterations. These two cases were sent to the clinic on account of intensive and irregular menstrual bleeding. A single irradiation of the pituitary body with 60 per cent of the H.E.D. was performed; after this the blood flow stopped. A moderate menstruation of normal type appeared, and this condition has continued now for about two years.

Furthermore, there is a case under treatment that has shown pronounced symptoms of acromegaly. The alterations are distinctly demonstrable by means of former photographs. Besides, the X-ray plate shows altered and enlarged sella turcica. The range of vision on the right side is somewhat reduced—on the left side to a great extent. Deposits of fat and water retention are present, as well as amenorrhea, which has been continuing for three years. This patient for the first time (in January, 1923) has received a dose of 80 per cent of the H.E.D. to the pituitary gland; in September, 1923, the same dose was repeated. In November, 1923, menstruation was reestablished, and is continuing regularly, though scantily. The acromegalic symptoms have disappeared almost completely, the face of the patient resembles its former appearance, there is no more retention, and the fat deposits are much lessened. The reduction of the range of vision remains.

Hypofunction of the pituitary gland, represented in its most pronounced form by Simmond's disease of cachexia hypophyseopriva, even in its weakened form is not to be treated by X-rays, hence, it is not necessary to enter upon this subject.

(E) Thymus and Ovary.—The interrelationship existing between the thymus and the ovary is difficult to sum up in detail. However, I shall mention an observation I have made in irradiating a thymogenous tumor. Menstruation ceased when the tumor began to grow. After the first effective irradiation, menstruation was re-established and continued until after a recurrence appeared. The second systematical irradiation of the tumor (a sarcoma) brought about a complete clinical retrogression. The general health of the patient was decidedly improved and she was free from all symptoms which might have indicated a tumor. A relatively strong menstruation occurred regularly every twenty-eight days. For eighteen months the patient was in good health; an increased and somewhat painful monthly discharge was the only symptom causing discomfort. In order to repress the intensive blood flow and to prevent conception, she was given a dose somewhat higher than the dose necessary for temporary sterilization. Seven weeks later the first phenomena of a newgrowth appeared, the tumor developed rapidly and responded only slightly to another irradiation. Two months later, the patient died from the disease. Naturally, it is very difficult to say whether the repression of ovarian function stimulated the growth of the new tumor.

Another case of thymogenous tumor with extensive supraclavicular metastases was treated at the same time. Only a local irradiation was given onto the tumor, but no

sterilizing treatment was applied. This patient has been well for two years.

Finally, two cases should be mentioned, that can be interpreted as hyperfunction or persistence of the thymus. In a patient, 22 years of age, first seen in 1921, amenorrhea had persisted for four years, a condition which had failed to respond to stimulative irradiation or diathermy. Her general health, even under favorable living conditions, was greatly impaired. When she was sent to the clinic, an enlarged shadow in the region of the thymus was evident on the radiograph. To this area 70 per cent of the H.E.D. was applied. Two months later, menstruation set in, which has continued regularly. The patient, formerly suffering from intensive congestions, is now in good health.

A second case was observed in 1924. For five years amenorrhea had persisted in this patient, a woman 23 years of age, accompanied by intense vasomotor symptoms, heat flashes, vertigo, and headache. The radiograph exhibited an enlarged shadow of the thymus region. The patient was in a poor state of health, in spite of favorable living conditions. The neck was thin, showing not the slightest indication of enlarged thyroid. When laparotomy was performed, enlarged cystic ovaries were found. One irradiation with 70 per cent of the H.E.D. was applied to the thymus. The patient recovered and regular menstruation has occurred for the last two years.

Surveying the results set down in this article, one may state unconditionally that further research work is indispensable. The whole domain of internal secretion, enriched by new results, must reconsider the old, apparently confirmed views. I do not dare to claim that the conclusions I have drawn in the second part of this paper could not be improved. Having confined myself to clinical results especially, I do think that one may accept from them certain deductions for the therapeutic application of X-rays. First of all, I have shown that with accurate dosage, temporary sterilization can be performed with the greatest probability of success; further, that persistent X-ray amenorrhea, usually designated as "castration," is by far superior to surgical castration with regard to biological results.

In according proper attention to the interrelationship existing between the various endocrine glands, we will succeed in avoiding many of the disappointments which we still experience in treatment. It is advisable, also, to look outside the ovary for the causes of increased menstrual blood flow and to refrain from X-ray treatment of the ovary in cases of dysfunction of the ovary combined with hypofunction of the thyroid.

I have purposely refrained from entering upon the subject of stimulative X-ray therapy of the ovary, since Dr. Seth Hirsch, at last year's congress, reported favorable results from this treatment.

Since a great proportion of the cases of amenorrhea is not dependent on the ovary alone, failures might be explained by the study of the interrelationship existing between the ovary and the other endocrine glands. But the more relevantly X-ray therapy is applied, the better will its value be appreciated.

SUMMARY

In this paper the author's own experiences with influencing endocrine glands by roentgen rays, made in the course of the last ten years, are given.

The first part shows the difficulties which are to be considered with regard to exact dosage in irradiating endocrine glands. As, taking into consideration the additional dose of scattered radiation, the Compton effect and the spatial or volume dose, it is now possible to administer a dose which is exactly measurable and reproduceable, the following differentiations can be obtained: (1)

the total destruction of a gland; (2) temporary impairment of the whole of the glandular tissue of the respective gland, with a definite qualification that reparation is still possible; (3) the complete destruction of highly sensitive cell groups with complete preservation of less sensitive cell groups; (4) the general increase of the activity of the cell; in other words, stimulation.

Further, it is shown what effects are produced in the ovary by graduated roentgen-ray quantities. The clinical results—total sterilization, *i.e.*, castration, permanent amenorrhea, or temporary sterilization—are demonstrated by histological alterations in the ovary, and it is proved that the various cell parts of the ovary have a different sensitivity to roentgen rays. The differences of sensitivity are stated in percentages.

Besides, it is shown that, with temporary sterilization, the influence of the ovary on the endocrine system—very important with regard to general health—is preserved. This is proved by the absence of deficiency symptoms and metabolic alterations, which occur with permanent amenorrhea and with total sterilization.

The second part deals with the different types of diseases resulting from disturbed interrelations between the various endocrine glands, insofar as roentgen treatment is in question.

I. Interrelationship between ovary and thyroid.

(*a*) *Thyroid dysfunction of the ovary.* This comprises polymenorrhea, dysmenorrhea, as far as they result from a hyperfunction of the thyroid. X-ray treatment of the thyroid gland is indicated in these cases.

(*b*) *Ovarian hyperthyroidism.* This deals with cases suffering primarily from an ovarian dysfunction, frequently on the base of inflammatory alterations, and which later on develop hyperthyroidism. X-ray treatment of the thyroid is not indicated with this type of disease, but temporary sterilization.

(*c*) *Dysfunction of the thyroid on the base of hypothyroidism.* The most important symptoms are polymenorrhea, increased and prolonged menstrual bleeding, together with hypofunction of thyroid. X-ray treatment of the thyroid is contra-indicated in these cases.

With cases of amenorrhea caused by hypothyroidism it is well to prescribe thyroid preparations together with ovarian preparations. Stimulative X-ray therapy should not be administered.

II. Interrelationships between ovary and pituitary gland and ovary and thymus.

It is shown by the example of some treated cases that with regard to X-ray therapy, it is necessary to take into consideration the relations between the different glands, if failures and impairment of the endocrine system are to be avoided.

DISCUSSION

DR. CURTIS F. BURNAM (Baltimore): I am sorry that Dr. Wintz has not had an opportunity to present his paper in full, and to give us a more complete picture of his radiation methods and results. We all feel greatly indebted to him for making this long journey across the ocean to give us the valuable results of his great experience.

If Dr. Wintz has developed a technic which permits him to give with perfect accuracy the various amounts of radiation necessary to produce permanent sterilization, partial sterilization, and simple reductions of the menstrual function, he has contributed a great deal to our therapeutic scope in gynecology. All of us are familiar with the variations in the clinical effects of

radiation—complete sterilization from the time of treatment, two or three periods before cessation of menstruation, no cessation of menstruation but reduction of excessive or painful menstruation to normal type. I have felt that there was a very great individual difference from patient to patient in this radiosensibility of the ovaries, and that it was necessary to keep down the dosage to a minimum at the single exposure, in order not to overdo in some cases. If insufficient radiation is given the first time, it is always possible to add to it.

My own experience has been more with radium than with X-ray.

I hope that Dr. Wintz will tell us more about the vasomotor disturbances and how they depend on the degree of change produced in the ovaries. That it is possible for patients to have normal menstruation and to go through normal conceptions and pregnancies after several years of radiation amenorrhea, we know from our own personal observations.

Referring again to the vasomotor disturbances, some patients are subject to them all their lives, some do not have them at or after the normal menopause, and many who are permanently sterilized by radiation do not have them. In cases where temporary amenorrheas are established, not infrequently they are most pronounced at the time menstruation is returning. My impression is that the hot flushings are not due to an absence of ovarian secretion, but to irregular functioning of the ovaries.

I hope we shall have the opportunity of reading in Dr. Wintz' paper his observation as to the association of the other internal secretory glands with the ovaries. I am referring particularly to the thyroid, adrenal, and pituitary glands. I should like particularly to know what have been the changes observed in the pituitary gland after radiation of the ovaries. I remember some years ago studying the ovaries of cats which had previously had the pituitary glands surgically removed. These ovaries presented an enormous proliferation of lutein-like cells in strands and strings, very similar to that observed in the ovaries of human beings suffering with hydatidiform moles or deciduoma malignum.

THERMOCAUTERIZATION OF MALIGNANT GROWTHS

THE USE OF THE DIRECT ACETYLENE FLAME AS A DESTRUCTIVE AGENT

By WILLIAM H. KENNEDY, M.D., and HAMILTON ROW, Ph.B., INDIANAPOLIS

WHILE the use of fire as a therapeutic agent dates back to prehistoric ages, the employment of the direct acetylene flame for the destruction of malignant growths is, so far as has been ascertainable, an entirely new procedure. Results with this technic have been so favorable that a description of the apparatus and procedure has been attempted for the benefit of the profession.

HISTORICAL

Cauterization either by the direct flame or heated objects applied to the body is one of the oldest of all therapeutic measures. Neolithic skulls six thousand years old show unmistakable effects of cauterization of the head. It is believed that this operation was performed by prehistoric surgeons for the relief of mental disease. Skulls exhumed in Peru, dating back about five hundred years, show similar evidences of cauterization. Moodie (1) has presented an interesting study of certain pathologic ancient skulls, from which it appears that cauterization of the scalp, leaving subsequent lesions on the skull, was practised in neolithic times in France and during later ages in Central Asia, the Canary Islands, Europe, Peru, and Africa.

Throughout the Middle Ages, cauterization was much practised in Europe. Before the invention of the ligature, military surgeons, notably Ambroise Paré, applied hot irons as a means of arresting hemorrhage. Indeed, it was Paré himself who finally substituted the ligature for cauterization.

Even as late as the early part of the nineteenth century, references appeared in the literature advising such treatments as the application of the cautery to the back of the neck for the treatment of epilepsy or melancholia. Percival Pott (1714-1788) found the profession of his time much addicted to the use of the cautery for complaints in which it could be of no possible benefit, and it was largely through his efforts that this instrument fell into disuse.

Giraud-Teulon (8), writing from Paris in 1863, described a new method of destructive cauterization in which he employed a small jet of flame produced by the combustion of ordinary illuminating gas.

In 1892, Byrne (2), of Brooklyn, brought the treatment of cancer with the cautery into prominence, when he published his article reporting favorable results in carcinoma of the cervix uteri. Percy (3), in 1912, perfected a technic for treating cancer with thermocauterization, and his procedure has been followed by many operators. Other workers who have reported favorably on this method of treatment include Scott (4), Kelly (5), of Sydney, Bloodgood (6), and Ochsner (7).

After a reasonably careful survey of the literature no references were found to the use of the direct acetylene flame for the destruction of accessible malignant growths. The method of this procedure is, therefore, offered to the medical profession as a new and useful therapeutic measure.

FACTS ABOUT ACETYLENE AND ITS APPLICATION AS A CAUTERY

Acetylene, or ethine (C_2H_2), is of the unsaturated hydrocarbon series and was discovered by Davy in 1836. It was synthesized and its constitution established by Berthelot in 1859. The great heat produced by acetylene when burned in conjunction with oxygen has for some years been used

industrially for the welding of iron and steel. Such procedure requires a heat well over 3,000° F., since the metal must be fused.

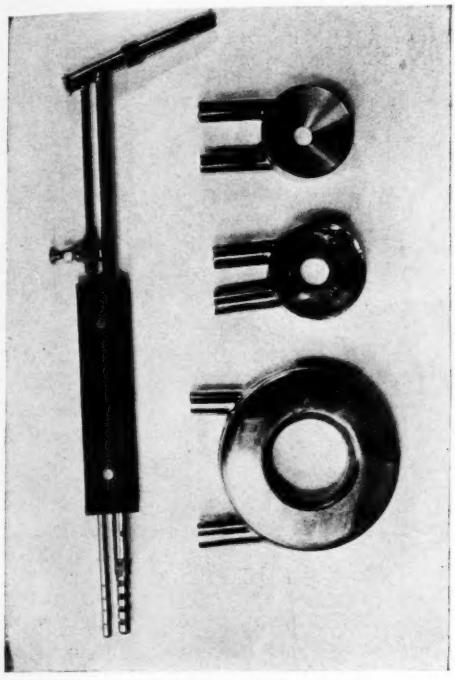


Fig. 1. The torch and its parts.

It is obvious that no degree of heat in any way approaching that of oxygen and acetylene can be produced by the thermocauteries as we know them to-day.

METHOD

The method to be described utilizes the flame produced by the combustion of acetylene gas and compressed air in a specially constructed torch. The torch and its accessories are shown in Figures 1 and 2. The following simple experiments were run with fresh beef and the oxy-acetylene torch.

Bits of muscle, tendon, fat, skin, and bone were subjected to the flame which produced a temperature of 6,300° F. The soft tissues were rapidly oxidized to ash while the bone was melted, an amorphous mass remaining as a residue.

Subsequently larger pieces of tissue were cut in two. During these latter procedures, the pitting effect of the flame was observed and on sectioning these pits, it was found that a zone of only one to two millimeters intervened between the base of the pit and normal underlying tissue. However, due to peripheral spread of flame the tissue surface was seared for some distance about the intensely destroyed depression.

The hollow metal ring of doughnut shape, with a constant flow of water through it, was then devised to limit the field of flame destruction. The ring was closely applied to the tissue surface and the flame was played through the central hole of the ring. The size of the central hole was the extent of the destruction circularly, while the time of application of the flame to the tissue determined the depth to which it was removed. To give some idea of the time required to remove a certain amount of tissue, it may be of interest to state that a hemisphere 3.75 cm. in diameter was excised in 40 seconds. The large ring in the illustration is 3.75 cm. in its inside diameter.

The Prest-O-Lite Company then devised a torch that is much more compact and easier to manipulate than any of their stock products. This torch was designed to use acetylene gas in conjunction with compressed air. The heat generated by this flame was from 3,500° to 4,600° F.

The torch was so designed that three sizes of jets could be fitted to the same handle, thus a flame of the desired size was obtainable. For small areas the small flame has been found most effective, while the larger flames are most useful in more extensive involvements. The inner diameter of the protecting ring, of course, limits the field of cauterization.

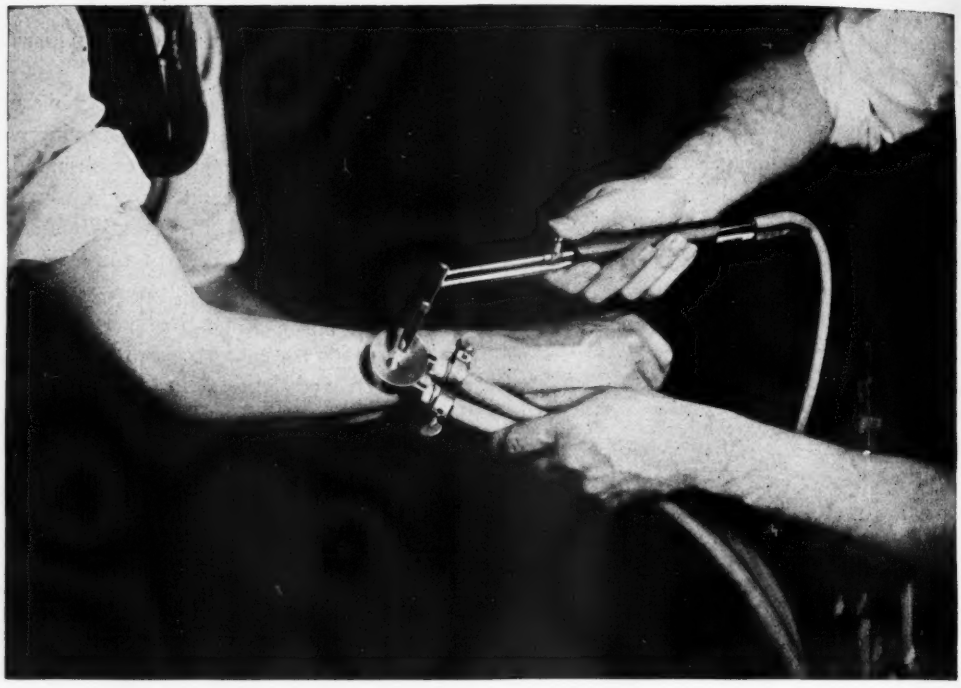


Fig. 2. Method of using the torch.

By directing the flame to the surface of the growth, one is able to rapidly remove the malignant area. In employing this direct acetylene flame method in a number of cases of accessible carcinoma, such experience has proved it superior to any of the other methods of thermocauterization now in use.

ADVANTAGES OF THE METHOD

The method described possesses the following advantages over other procedures for thermocauterization:

1. An extreme degree of heat is brought directly to the malignant tissue that one wishes to destroy.

2. The area under treatment is visible at all times, so that the extent of tissue destruction can be seen.

3. There is no manipulation of the tissue that could in any way cause dispersion of malignant cells present in the growth through the lymphatics or blood stream. In case of secondary infection, the possibility of dissemination of the micro-organisms is likewise reduced.

4. There is a sharp line of demarcation between the destroyed and the healthy underlying tissue. This zone may measure only ½ mm. in thickness. For this reason, healing progresses more rapidly and there is no necrotic residue to serve as a potential culture medium for bacterial growth, as when electrocoagulation is employed.

5. The rapidity of accomplishing the desired result adds to the comfort of the patient and the convenience of the operator.

SUMMARY

A new method of thermocauterization is described, whereby malignant tissue is destroyed by the direct application of the

acetylene flame. A specially constructed torch utilizing acetylene and compressed air and designed to furnish three different sizes of jet is employed. In order to avoid scorching of the surrounding tissue, a protecting ring through which cold water is circulated has been devised.

In experiments on tissue, the acetylene flame was found to reduce bone to a glazed amorphous mass and the remaining tissue to ash. Clinical trials have suggested that this method furnishes a more effective and satisfactory procedure for the thermocauterization of accessible malignant growths than those now in vogue.

REFERENCES

1. Moodie, R. L.: Use of the Cautery among Neolithic and Later Primitive Peoples. Surg. Clin. Chicago, Aug., 1920, IV, 851.
2. Byrne, J.: Vaginal Hysterectomy and High Amputation, or Partial Extirpation by Galvano-cautery in Cancer of Cervix Uteri: An Inquiry into Their Relative Merits, Brooklyn Med. Jour., Nov., 1892, VI, 729.
3. Percy, J. F.: Uterine Carcinoma and its Treatment by Continuous Low Heat. Am. Jour. Obst. and Gynec., July, 1923, VI, 78.
   Idem: Results of the Treatment of Cancer of the Uterus by the Actual Cautery, with a Practical Method for Its Application. Jour. Am. Med. Assn., March 9, 1912, LVIII, 696.
4. Scott, A. C.: Cautery Dissections for Metastatic Cancer, Surg. Clin. N. A., Oct., 1922, II, 1429.
   Idem: Glandular Block Dissections for Metastatic Cancer. Jour. Am. Med. Assn., Nov. 7, 1925, LXXXV, 1447.
5. Kelly, D.: Treatment of Cancer by Low Grade Heat. Med. Jour. Australia, Jan. 9, 1926, I, 34.
6. Bloodgood, J. C.: Cited by Scott, A. C., Jr.: Cauterization and Cautery Excision of Cancer. Jour. Am. Med. Assn., Oct. 9, 1926, LXXXVII, 1188.
7. Ochsner: Ibid.
8. Giraud-Teulon: Nouvelle methode de cauterisation destructive, etc. Bull. gén. de thérap., Paris, 1863, LXIV, 540-545.

NEW DEVICE FOR THE REDUCTION OF FRACTURES

USES, ADVANTAGES, AND RESULTS

By L. G. McCUTCHEN, M.D.,
Roentgenologist, St. Louis City Sanatorium and St. Mary's Infirmary

THE problem of a fractured extremity is by no means a new one to the medical profession, nor are its various methods of solution. However, we have not obtained that degree of perfection which leaves little or no room for improvement over these methods. In the X-ray, as well as in the operating room, the doctor is still casting about for some means of providing extension other than that supplied by his own strength and that of his assistants, because the pull supplied in this manner is

Fig. 1. Impacted Colles' fracture, before reduction.

Fig. 2. Same case as Figure 1. Fragments in perfect position. Note space between fragments at point of previous impaction.

Fig. 3. Fracture of surgical neck of humerus, before reduction.

Fig. 4. Same case as Figure 3, after reduction. Fractured surgical neck of humerus in perfect position.

Fig. 5. Fragments in perfect position, after reduction.

Fig. 6. Comminuted fracture of tibia, before reduction.

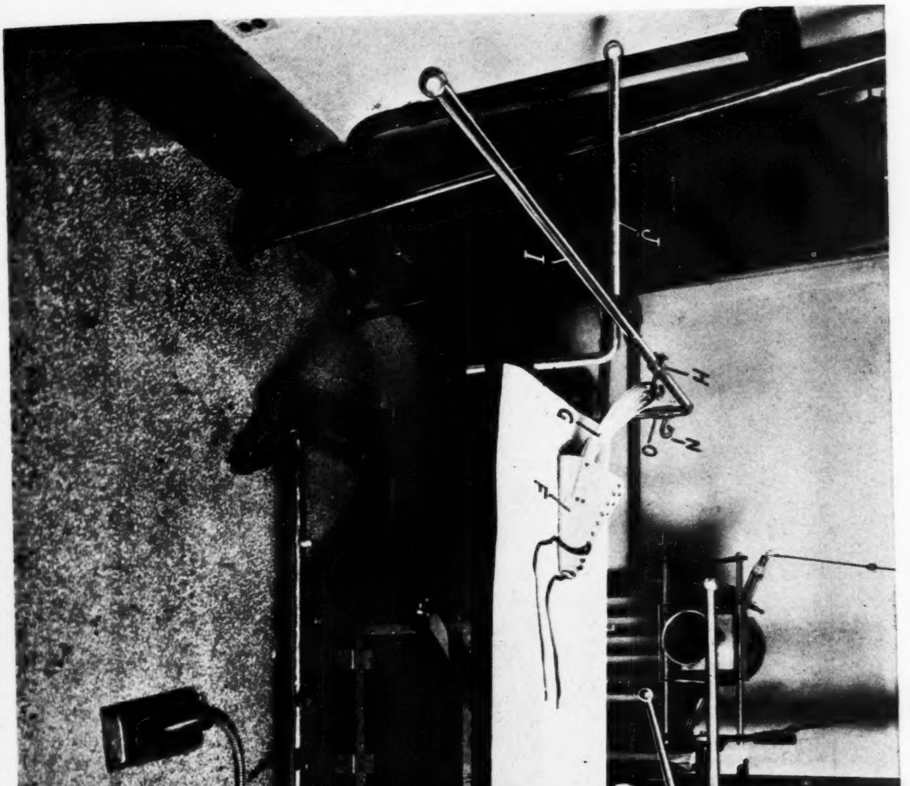


Fig. 7. Device for the reduction of fractures, with key to references. *A*, arc-track along which back-piece "D" slides; *B*, center peg for crotch or axilla; *C*, setscrews which fix "D" at any place along arc; *D*, back-piece; *E*, socket at head of table into which "D" fits; *F*, cuff for wrist or ankle; *G*, straps; *H*, hook with setscrew which slides along lever "I"; *I*, traction bar; *J*, lever to hold extension; *K*, pelvic support; *L*, levers for suspension of lower extremities for the application of casts; *M*, back and head rest; *N*, hook to which normal extremity is attached to prevent rotation on crotch peg; *O*, collar to adjust height of normal extremity.

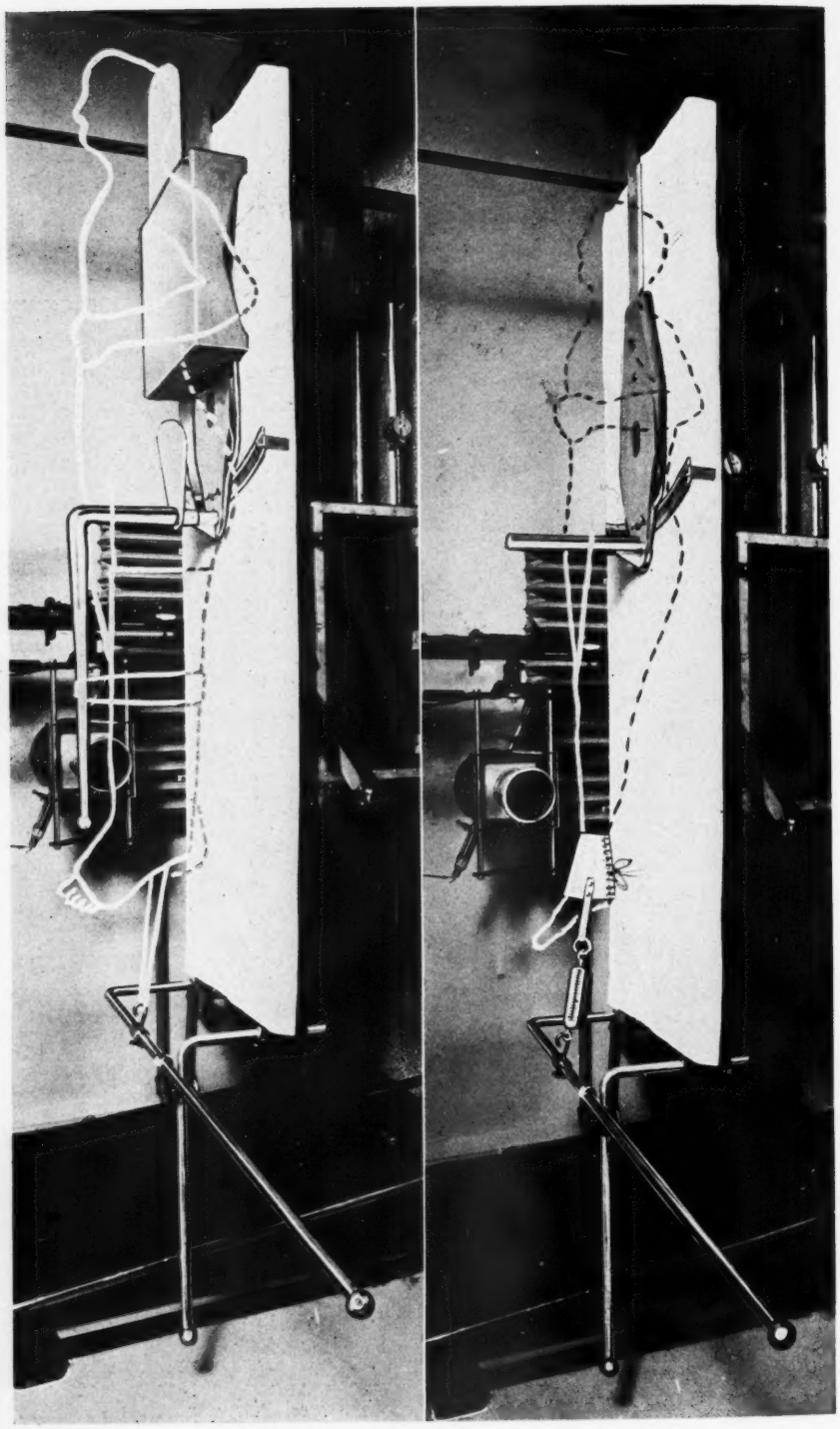


Fig. 8 (*above*). Device, with cast applied.

Fig. 9 (*below*). Device, with cuff attached to ankle, peg in crotch.

not always adequate, and, furthermore, after such exertion the surgeon is not at his best to continue operative procedures for the remainder of the day. But even the surgeon has not felt the need for some simple mechanical means of extension more keenly than the radiologist sharing his problem. In my own case, I am sure this is true, and with a view to providing this sort of extension I have devised an apparatus, which, I may say in the light of my own experience as well as of the opinions of others, I believe will go a long way towards simplifying the problem of the fractured extremity.

The device is used to provide extension for fractures of both the upper and lower extremities. It is composed of an adjustable piece "D" (see Figure 7), which can be made shorter for upper extremity and longer for lower extremity fractures. One end of this strip is attached by a socket "E" to the head of the table. To the other end is attached a peg "B," which slides to either side of the table crosswise along an arc "A."

For fractures of the upper extremities, the peg is placed in the axilla; for the right arm, it slides to the right side of the table; for the left arm, to the left side of the table. The cuff is attached to the wrist.

For fractures of the lower extremities, the peg "B" is kept in the center of the arc "A," and in the patient's crotch. The cuff is attached to the ankle. Thus, this apparatus differs from the fracture table in that the central peg is not fixed in the center of the table, but is adjustable lengthwise as well as crosswise, which is very important for fractures of both the upper and lower extremities. The extension for both extremities is obtained by a longer lever "I," attached to the foot of the table. The traction obtained by the lever is superior to other methods, because increase and release of extension is immediate. The extension

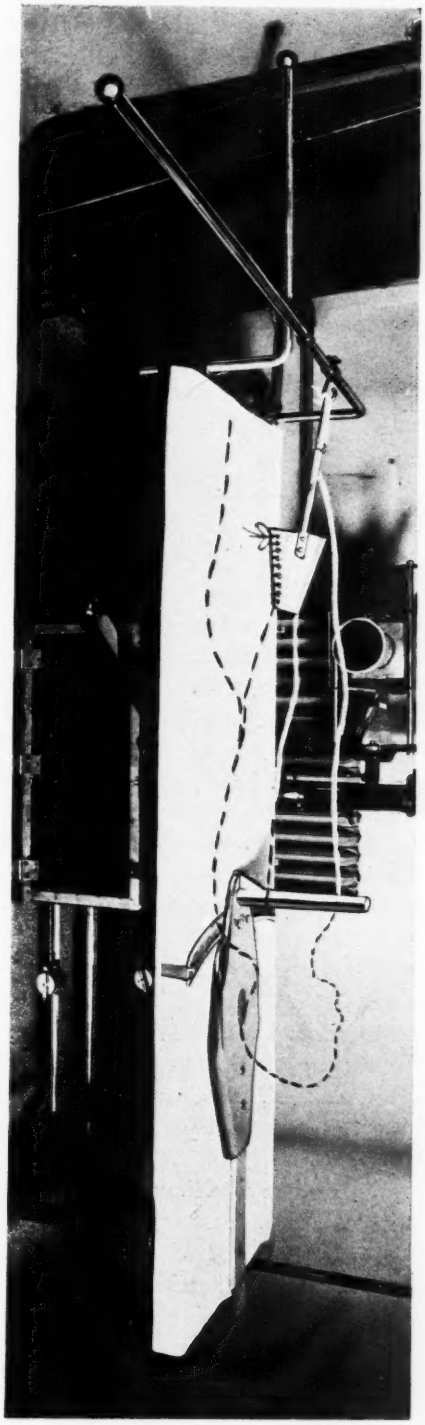


Fig. 10. Device, with cuff attached to wrist, peg in axilla.

Fig. 9 (detail). Device, with cuff attached to ankle, peg in crotch.

is held (during application of casts, etc.) by a hook on the small lever "J."

For oblique fractures, which will not remain in position after attempted reduction, the amount of extension desired in pounds

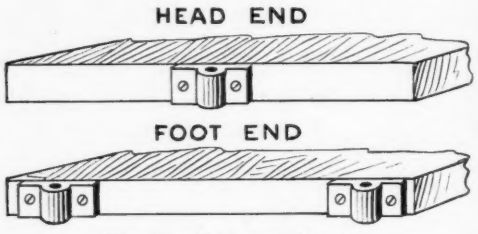


Fig. 11. Table attachments.

is determined by interposing a scale between the cuff and the traction bar. This pull in pounds, which has been measured during extension under the fluoroscope by the scales, can be applied to the extremity by weights over the end of the fracture bed, holding the fragments in approximately the same position during the healing process as that seen under fluoroscopic vision.

The device can be attached to the end of a fracture bed. Interpose a scale between the cuff and the traction bar in order to determine the exact pull on the extremity. The extension may be increased or decreased by shifting the hook on the small lever; thus, the number of pounds' pull can be kept constant. The extension piece is placed in the center of the bed and attached at the head. It may be covered with a mattress. The peg is well padded and placed in the crotch. The other extremity can be fixed to the vertical portion of the traction bar.

The ordinary radiographic and fluoroscopic table can be arranged so as to get two views with the use of a black lead glass fluoroscopic bowl, which is light-proof. This bowl, containing the tube, can be placed on the regular tube-stand and rotated so that the ray will be parallel with the table from the side (see Figure 7). In

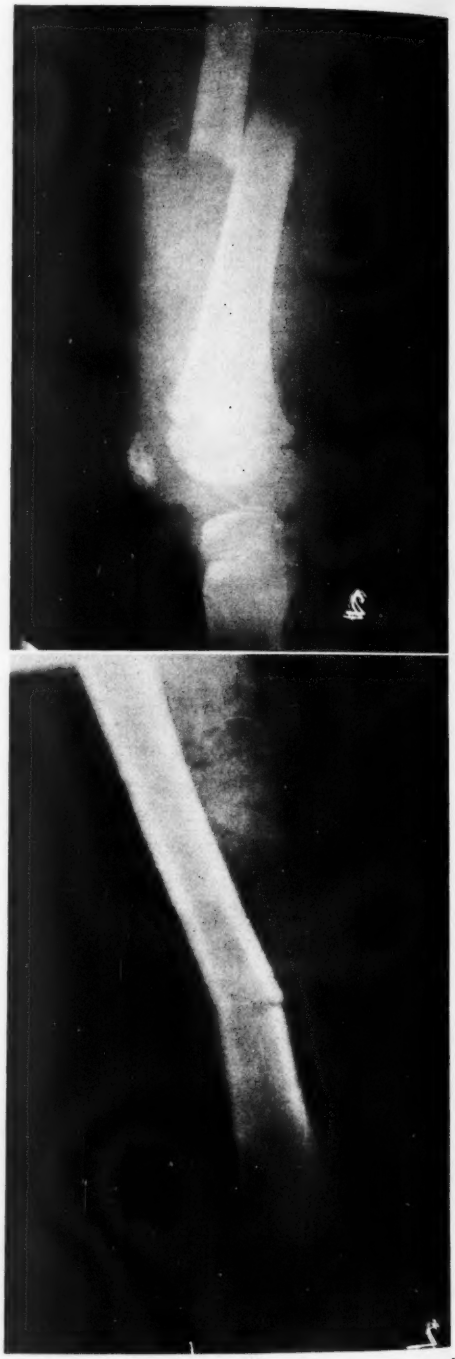


Fig. 12 (*above*). Complete transverse fracture of femur, with overriding. Before reduction.
Fig. 13 (*below*). Same case as Figure 12, after reduction. Fragments perfectly approximated.

order to get a side view, pull the string which switches from the fluoroscopic tube under the table to the radiographic tube in the light-proof bowl, using the fluoroscopic setting. Cone the ray down to the size of the fluoroscopic screen, using 1 mm. of aluminum as filter, which also closes out the light from the tube (see Figure 7).

The device, which is portable, is extremely simple in its operation, and the amount of extension obtained by it is equivalent to the pull of more than six men. It is made of casted aluminum. This material was chosen because it is pervious to X-ray—it is light and strong, and will not rust nor warp. It is attached to the X-ray or operating room table by means of three sockets —one at the head and two at the foot of the table. As these sockets are bolted on the ends of the table so that they fit evenly with the surface, they in no way mar the table or interfere with its function. It takes less than three minutes to attach the device and as little time to detach it when through. It can then be set aside or carried elsewhere for further operations (one of the advantages of being portable, in addition to saving space). In a smaller hospital it eliminates the necessity of a separate fracture room and a separate fracture table.

I feel that it is far enough beyond the experimental stage, to be given consideration from a scientific standpoint. There are, undoubtedly, a great many in the medical profession who have thought deeply of this sort of device and a summary of such facts should go a long way towards putting the fracture service on a sound basis, and help to render it a highly specialized unit. This device, I believe, will help to eliminate the extension problem in the X-ray and operating rooms, and provide the missing link in the fracture service.

RADIATION TREATMENT OF MALIGNANCY OF THE CERVIX BY RADIUM EMANATION[1]

By IRA I. KAPLAN, M.D., Radiation Therapist in Charge of Service, Bellevue Hospital, NEW YORK CITY

BELLEVUE HOSPITAL is primarily one for acute cases requiring immediate attention, chronic cases usually being transferred to other institutions. For this reason Bellevue has no distinctive cancer department, and keeps for treatment only those cases of malignancy that require limited hospitalization. In the management of these patients, many types of cases that can be treated as ambulatory are referred to the radiation department.

Only those cases of moderately advanced carcinomas of the cervix still amenable to treatment are admitted to our service. The type of patient received, however, is usually poor, of low intelligence, to whom it is difficult to explain the seriousness of her lesion, and whom it is difficult to follow up once she has been sent home apparently cured, or after her acute symptoms, such as bleeding, and pain may have been relieved.

Many of these patients either leave the neighborhood from which they originally applied for treatment, or they refuse to answer requests to come to the hospital again for follow-up examination. Most of the cases of cervix malignancies seen at Bellevue are in the advanced stages. They are hopeless at the beginning; in some instances frightfully involved when we see them, having been totally neglected or perhaps mistreated elsewhere.

In spite of this, as we shall see, the results attained in the one and a half years since this work has been started have been very gratifying. There were 56 cases admitted on the service during the period May 1, 1925, to October 1, 1926. Of these, 28 cases were accepted by the Radiation Department for treatment. The others were not treated by us: some were beyond palliative measures; one died on admittance; the biopsy was negative in some; the primary lesion was elsewhere in others, and the remainder were transferred to the City Cancer Hospital or sent home.

Our work is carried on with the co-operation of Dr. Frederick C. Holden, Director of the Gynecological Service at Bellevue. On Dr. Holden's service, carcinoma of the cervix is no longer considered an operable condition, even in so-called operable stages. Some surgeons still persist in hysterectomy following radiation treatment. This is not done on Dr. Holden's service. So in these cases radiation has to bear the complete therapeutic responsibility.

I shall not discuss the question of the advisability or benefits of radiation therapy over other methods in the treatment of carcinoma of the cervix. This question has been fully discussed by other workers in cancer therapy. I shall limit myself to describing our procedure at Bellevue Hospital, and just mention in passing some of the methods in use elsewhere.

The Bellevue method is somewhat different from other methods in vogue, both on account of the type of cases we have to treat and on account of the facilities at hand. Let me quote some methods of other clinics for purposes of comparison.

1. At the Radium Institute, London, cases are treated with radium alone or are operated upon first and then treated with radium.

2. In Stockholm, at the Radiumhemmet, they use large doses of radium repeated at intervals as needed. No X-rays are used.

3. Seitz, in Frankfurt, uses X-rays

[1]From the Gynecological and Radiation Service, Bellevue Hospital, New York City. Read before the Radiological Society of North America, at Milwaukee, November, 1926.

chiefly and supplements this with a single dose of radium intracervically.

4. In Erlangen, Wintz claims excellent results with X-rays alone.

5. Voltz, who is in charge of the radiation at Döderlein's clinic in Munich, makes use of a heavy dose of X-ray, supplemented with radium treatment, which is given at the same time.

6. Fraenkel, of Breslau, in personal conversation with the writer stated that he uses operation, radium, and X-rays. He operates, where possible, after radium treatment has been given.

7. At the Radium Institute, in Brussels, Bayet uses both X-rays and radium. The latter is used locally by puncture or by intra-abdominal application.

8. At the Curie Institute, in Paris, both X-rays and radium are used, either separately or together. One course of treatment is given and is not repeated. Recently, Régaud has treated some cases with external abdominal packs of radium instead of the X-rays, in conjunction with radium applied locally to the cervix.

9. Gosset, in Paris, treats the lesion first with radium and then operates.

10. At the Cancer Institute, in Strassburg, Gunsett follows somewhat the Curie method of Régaud.

11. At the State Cancer Institute, in Buffalo, New York, cervical carcinomas are treated with radium applied locally through the vagina and abdominally by packs, followed by X-ray therapy to the pelvis.

12. At the Memorial Hospital, New York, the lesion is treated locally with bomb and radium puncture, and the pelvis externally with radium packs and X-ray.

13. At the Mayo Clinic, radium and X-rays are used—radium in small repeated doses and X-rays occasionally.

14. Kelly, in Baltimore, uses extensive doses of radium locally.

15. At the Woman's Hospital, New York City, radium is employed intracervically plus radium puncture when needed. At present they are beginning to use X-ray therapy to the pelvis as well.

All these, except the Régaud school, use radium in large doses for one or repeated treatments. X-rays are used only as a supplementary aid.

In our method we attempt to treat the lesion, first, by attacking it locally to clear up the infection, then the pelvis with the idea of blocking off the lymphatics and destroying metastatic foci, and finally the local lesion, with the idea of destroying the tumor hearth, and to deliver a sufficient dosage in the proper time to give the desired result.

Ewing says that "effective irradiation excites a favorable reaction on the part of the body as a whole." He also claims that there is a difference in the biological reaction upon different tissues by the use of X-rays and radium. Connective tissue is more vulnerable to the X-rays, according to Ewing, and tumor tissue to radium. Régaud, too, calls attention to the selective action of radium. Our method is directed towards this goal. We use radium where its selective action on the tumor mass itself is most effective, and X-ray on the tissue where metastatic foci are likely to occur, where connective tissue predominates.

In order to build up the body reaction as a whole the general condition of the patient from the hygienic and nutritive standpoints is taken care of before radiation is begun.

If, after admittance to the gynecological service, the case is considered desirable for treatment, it is placed under the care of the radiation therapist, who then co-operates with the gynecological staff.

Treatments are planned according to the extent of the lesion present. If marked ulceration and infection are present in the vagina, a course of disinfection with douch-

es initiates the treatment. The patient is shaved and cleansed externally; the bowels are cleansed with enemas. Douching with boric acid solution or with 2 per cent glucose solution twice daily is carried out until

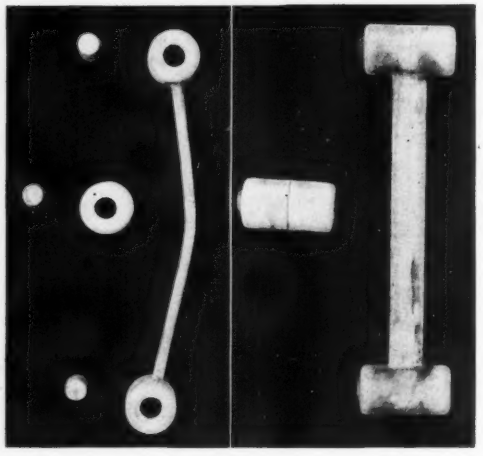


Fig. 1*A* (*left*) Colpostat, end view. 1*B* (*right*), Colpostat, side view.

the vagina has been cleansed thoroughly and much of the induration about the cervix reduced. Following the douching, the vagina is irrigated with 2 per cent methylene blue solution, a mild antiseptic which seems to clean up the infection more rapidly.

Radiation is not begun until the disinfection or cleansing is completed, so that little infection is present in the vagina when the treatment is given. Meanwhile the general condition of the patient is improved by dietetic and hygienic methods. Constipation, which is present in nearly all cases, is treated by mineral oil and magnesia, and enemas if necessary.

A biopsy is taken of the lesion in all cases. I do not believe biopsy spreads the disease or does any material harm. The lymph and blood channels are already blocked by the ulceration, and taking out a piece of the ulcerated area does not extend the lesion. During this preliminary stage the patient, when able, is allowed to be up and about the ward.

After the period of cleansing has been accomplished, the patient is thoroughly examined again for the extent of the lesion, and to determine whether or not distant metastasis is present. X-rays of the chest and of the spine and pelvis are taken, too, in order to discover possible distant metastasis. In one severe case, the patient came to the hospital for a large swelling over the left shoulder and neck which proved to be metastatic from a cervical carcinoma.

A definite plan of treatment is worked out before the radiation itself is done. This varies, depending on whether (1) the case is simply one for palliation of the local or metastatic lesion, (2) one in which recurrence in the vagina is present, or (3) an early case wherein it is hoped a permanent cure may be attained.

If the case is one for palliation alone, a primary or metastatic lesion, deep X-ray therapy is used. In post-operative recurrence where local radiation is impossible, X-ray alone is used. In cases wherein the local lesion is most prominent, X-rays are used with radium.

In all cases, deep X-ray therapy is used over the pelvis. The mode of treatment and the factors used are as follows: 200 K.V., 4 ma., 30 to 50 cm. target distance, 0.5 Cu. and 1 Al. filter, 9×12 or 15×15 cm. portals. Usually two portals anteriorly and two posteriorly are treated, covering the pelvis right and left. If the bladder is also involved, an additional central portal is given over the pubic area. The treatment is given in divided doses, alternately; that is, the first day anterior, right and left pelvis is treated with 25 per cent of the erythema dose. The next day the posterior pelvis, right and left, the third day

anterior pelvis again, and so on each day until four or five doses have been given over each area, depending on the case. This gives a depth dose of 60 to 75 per cent on the lesion. During this period the patient is douched two or three times daily, given a copious fluid diet, and is induced to take quantities of citrus fruits or fruit juices. This eliminates to a great extent the tendency to roentgen *kater*. Our patients seldom suffer from radiation sickness. On the last day of the X-ray treatment the patient is examined vaginally, the uterine canal is measured when possible, and a plan for the radium treatment (which is to follow immediately) is made out.

The treatment with radium depends on the histopathology, the amount of involvement and extension of the lesion, and whether or not the uterine canal is open and accessible.

Unfortunately, Bellevue Hospital owns no radium nor has it an emanation plant of its own. Emanation is bought when and as needed from the Radium Chemical Company, which supplies us the emanation upon prescription, with the proper filters we require.

When one has to use radium emanation, some modification of the ideal treatment method is necessary. The dosage has to be figured somewhat differently than when radium element is used (4). For example, to get 5,000 millicurie-hours, an initial starting quantity of emanation of 60 millicuries is necessary, and this is applied for seven days. The same result is accomplished with 50 milligrams of radium element in four days. For each case the plan of irradiation is worked out beforehand, and the required dose is determined. Then the amount of radon required to give this dose over the requisite time is calculated. At times the radon tubes are replaced with new ones during the course of treatment to give the required dosage.

HISTOLOGY

We have found in our cases that the most common form of pathology is plexiform epithelioma. This type is a sort of transitional form, between the basal and squamous, and is quite radiosensitive to even small doses. Of the 28 cases of cervical cancer in our series, there were—

Plexiform type	13 cases
Adenomatous cancerous type	4 cases
Squamous cell type	5 cases
Basal cell type	2 cases
Undifferentiated	4 cases

The dose varies according to the amount of local involvement from 4,000 to 7,000 millicurie-hours. If the lesion is limited to the cervix, we use about 4,500 millicurie-hours, half in the cervical canal and half in the vagina, and according to the extent of parametrial involvement we increase the vaginal dosage on one or both sides. In those cases where a large mass has replaced the cervix so that the canal is obstructed or not found, the mass is first treated vaginally and then, when the canal is located, an intra-uterine applicator is applied. When the mass itself is involved and offers an obstruction, this mass is first treated. The type of applicator we use is a modified form of the "Colpostat,"[2] as designed and used at the Curie Institute in Paris. It consists of a flexible rubber tube for the uterus and a specially designed rubber applicator for the vagina. In the rubber tube and applicator are placed the filtered radium emanation tubes. For filtration in the uterus 1 mm. platinum and in the vaginal applicator 2 mm. platinum is used, and, to take care of the secondary radiation, a very thin layer of aluminum is wrapped about the platinum.

Depending on the length of the uterine canal, one or two or three filter tubes are

[2] Made for us by the Hospital Supply Company, of New York City.

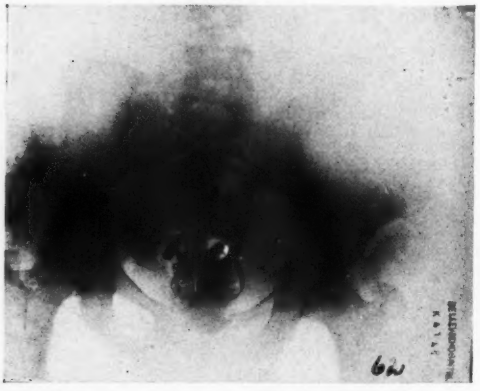


Fig. 2. Radiograph showing Colpostat in place.

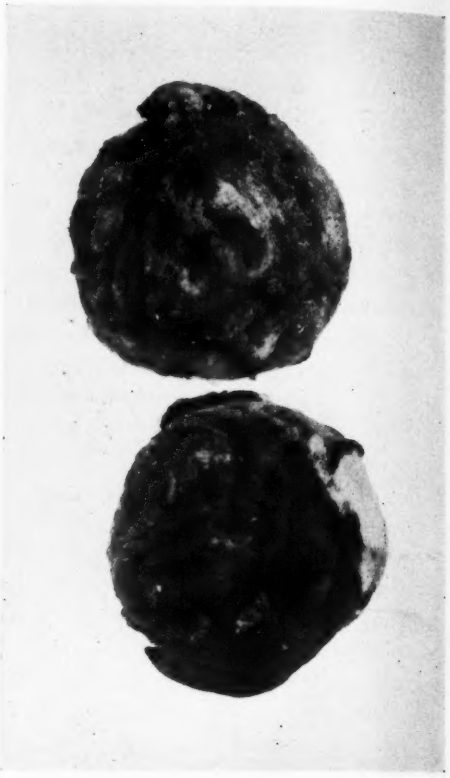


Fig. 3. Cauliflower mass amputated from cervix, with endothermy, before use of radium applicator.

placed in tandem in the rubber sound to be inserted in the uterus. The vaginal applicator consists of one or two corks, 3 cm. long by 1½ cm. wide, rounded on the ends and with a hole bored through its length for insertion of the radium capsule. Sometimes two corks are moulded together on a piece of rubber-covered clock spring: some corks are used singly. Previously we used bottle corks in place of rubber. The radon tubes are put in the corks and the holes are closed with cork stoppers, then the corks are boiled in paraffin, rendering them moisture-proof, and at the same time sterilizing the apparatus. The "Colpostat" is placed in the vagina with the spring bent, and as this straightens out the corks are forced against the cervix on either side in the region of the parametrium. Depending on the space in the vagina, one or more corks are added against the cervix. In this way, with the uterine tube and the vaginal corks, cross-firing on the lesion is accomplished. The vagina is packed with gauze above and below the corks, protecting the bladder and rectum from direct radiation.

The insertion of the radium, both in the vagina and in the uterus, is carried out without anesthesia. The patient is prepared as for operation, shaved, given an enema, and fifteen minutes before treatment a quarter of a grain of morphine hypodermically. She is then put in position as for a gynecological examination, a large size speculum is inserted, and the vagina is thoroughly cleansed. The cervical canal is located and gradually dilated with long straight metal dilators, starting at No. 10 French, and dilating until No. 26 is passed easily. If this is done slowly and carefully, very little discomfort is experienced by the patient. Seldom is much bleeding caused by this procedure. When the canal is properly dilated the uterine radium applicator is inserted with about one inch of the tied end extending from the canal. Then the cork applicator is put in place, and the uterus packed with plain or iodoform gauze, a vulva pad applied, and the patient

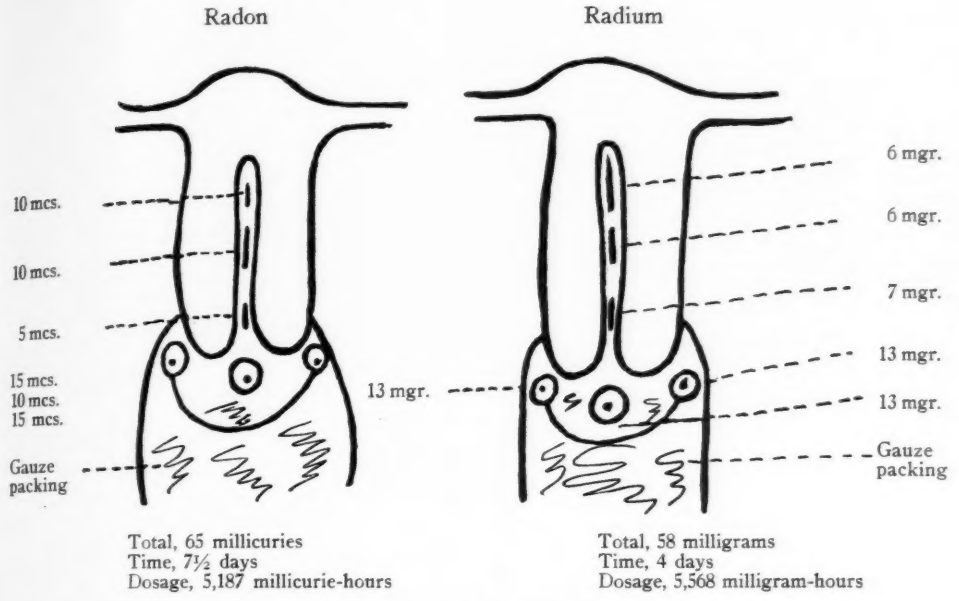


Fig. 4. Diagram showing how radium application is made. Comparison between applications with radium and radon, showing increased time required with the latter for the same dosage. In uterus: rubber sound containing 3 tubes of platinum-filtered activity; filtration equivalent, 1 mm. In vagina: special rubber Colpostat, with platinum filters; equivalent, 2 mm. Colpostat held in place by gauze packing.

is sent back to bed. She is not allowed to sit up in bed, but may be somewhat elevated on pillows. Fluids are given copiously, especially lemonade or orangeade; these latter help to prevent and alleviate radiation sickness.

If pain is present, codeine is given. The bowels are allowed to rest. Each day the applicator is removed and the vagina cleaned, packed, and the patient is again put to bed. The time of treatment varies with the dosage required and the initial amount of radon started with, usually from six to eight days.

Now, in a case where the vagina is obstructed, this mass may be treated with a local applicator, direct puncture with seeds, or filtered needles. The needles are removed after six or seven days and then immediately, or a few days later, the regular cervical applicator is inserted in place, and the treatment for the cervix is carried out.

If the cervical canal is obstructed with a large cauliflower mass blocking the vagina, the mass is removed with endothermy. In our work we use the Peerless Multotherm,[3] with specially constructed long insulated cutting points so that insulated speculums are not needed when the mass is removed. The "Colpostat" and uterine tube are then put in place. Sometimes complete removal is not possible. In such a case as much growth as feasible is removed with the Multotherm and then seeds and filtered needles are inserted in the remaining mass. When the mass has receded the canal may be located and the usual treatment carried out, with the dosage so arranged as to prevent radiation necrosis at the area already treated.

The patients are kept in bed during the course of treatment. If the temperature

[3]Made by the Peerless Electro-medical Corporation, of New York.

rises above 102 degrees the radium applicator is removed, the vagina cleansed, and the patient allowed to rest without radiation for from twelve to twenty-four hours. The radiation applicator is removed at a specified time in each case, and the patient is kept in bed another day following removal. If the temperature is normal, she is allowed to get up and about the next day, and in three days is sent home. She receives three douches daily with boric solution, and when sent home is instructed as to bowel hygiene and douching. She is asked to report once each week for examination during the first month, twice the next month, and then once monthly for a year.

Inasmuch as this work was started only two years ago, it is too soon to report results. Up to date, however, we have records of five deaths, one shortly after treatment, the others 6, 7, 9, and 13 months after treatment. Four cases have been lost track of: these may or may not be living.

TABLE I

Cases treated	28
Known dead	5
Lost track of	4
Still living	19

TABLE II

19 Living Cases

17 months after treatment	2
16 months after treatment	3
12 months after treatment	1
11 months after treatment	1
10 months after treatment	1
2 to 10 months after treatment	11

TABLE III

Color

White women	23
Colored women	5

TABLE IV

Age

The youngest case treated was a married woman 28 years old, and the oldest 65 years of age.

28 to 34 years old	6 cases
35 to 44 years old	6 cases
45 to 54 years old	10 cases
55 to 65 years old	6 cases

TABLE V

Marital State

Unmarried	1
Widows	5
Divorced	1
Husband living	21

TABLE VI

Menopause

Before menopause	16
After menopause	12

TABLE VII

Children

Only four cases had abnormal labor. Only one reported lacerations.

No children	3
One child only	10
Two or more children	15

TABLE VIII

Symptoms

The symptoms were varied, from an occasional vaginal pain to severe bleeding and pains. Five cases were recurrences following partial hysterectomy or cervical amputation; the others were primary cervical lesions.

Chief Complaint

Irregular menstruation	10
Severe persistent bleeding	16
Severe pelvic pains	1
Vaginal pains	1

TABLE IX

Wassermann

All cases had routine Wassermann tests; only two were positive—one colored woman and one white woman.

TABLE X

Extent of Lesion

Cauliflower mass cervix	5
Parametrium involved	23
Metastasis elsewhere	12
Limited to the cervix	5

TABLE XI

Deaths

At the end of treatment	1
6, 7, 8, 9, 13 months, respectively, after treatment	1 each

Causes of Death

Asthenia and cachexia	4
Uremia	1

SUMMARY

Carcinoma of the cervix is not operated upon at Bellevue Hospital.

Biopsy is done in every case.

The lesion is treated by (1) disinfection of the local area; (2) X-ray therapy of the pelvis; (3) radium therapy to local lesion; (4) radium puncture and endothermic surgery performed when needed.

The dosage varies with the histology and extent of the lesion.

The treatment is given at once, with small doses over long periods of time.

High voltage X-rays, with heavy filtration, and radium emanation in heavily filtered platinum tubes, are used for the specific radiation therapy.

REFERENCES

1. Bailey, H., and Healy, W. P.: Jour. Am. Med. Assn., Oct. 4, 1924, 1055.
2. Bailey, H.: Radium Report of Memorial Hospital, 1924, p. 158. Paul B. Hoeber, Inc., New York.
3. Bowing, Harry H.: Am. Jour. Obst. and Gynec., March, 1926, XI, 400.
4. Coutard, H., and Regaud, C.: Jour. Rad. et d'electrol., April, 1926, X, 152.
5. Delporte, F., and Cahen, J.: Le Cancer (Belgium), November, 1923, I, 28.
6. Ewing, James: Neoplastic Diseases, 2nd ed., 1922. W. B. Saunders Company, Philadelphia.
7. Ewing, James: Am. Jour. Roentgenol. and Rad. Ther., February, 1926, XV, 93.
8. Farrar, L. K. P.: New York State Jour. Med., August, 1925, XXV, 855.
9. Ferroux, R., Monod, O., and Regaud, C.: Jour. Rad. et d'electrol., January, 1926, X, 21.
10. Gosset, A., and Monod, O.: Paris méd., Feb. 16, 1924, LI, 158.
11. Healy, W. P.: Am. Jour. Roentgenol. and Rad. Ther., December, 1925, XIV, 542.
12. Heyman, H. V.: Jour. Obst. and Gynec. of British Empire, Spring, 1924, XXXI, 1.
13. Pinch, A. E. H.: A Clinical Index of Radium Therapy. Radium Institute, London, Eng., 1926, p. 96.
14. Regaud, C.: Archiv. d'élect. méd. (Bordeaux), September, 1923, No. 492.
15. Regaud, C.: Gynec. et Obst., Paris, October, 1925, XII.
16. Schreiner, B. P., and Kress, L. C.: New York State Jour. Med., December, 1924, XXIV, 981.
17. Voltz, V.: Wien. klin. Wchnschr., 1925, 1396.

THE RELATION OF THE DEGREE OF THE HISTOLOGICAL MALIGNANCY TO THE PROGNOSIS AND TREATMENT OF CARCINOMA OF THE UTERINE CERVIX[1]

By HENRY SCHMITZ, M.D., CHICAGO

From the Department of Gynecology of the Loyola University School of Medicine, Mercy and Cook County Hospitals

THE type of cell and the degree of differentiation and anaplasia play an important part in the degree of malignancy of tumors. Many attempts have been made to correlate the histopathological findings with the clinical prognosis of carcinoma, also, to determine thereby the prognosis of surgical and radiological treatment. An investigation on the relation of the histopathological findings to the prognosis of radiation treatment in carcinomata of the uterine cervix forms the purpose of this communication.

Martzloff (1) reported a better five-year end-result from surgical treatment in the spinous cell carcinoma of the uterine cervix, namely, 47 per cent; in the transitional cell types, 24 per cent, and in the basal cell types only 9.5 per cent. Broders (2) showed a very definite connection between the cellular differentiation and undifferentiation of carcinoma and the good clinical end-results obtained after treatment. He recognized four grades of carcinoma: Grade 1, in which differentiation ranges from 100 to 75 per cent, and undifferentiation from 0 to 25 per cent; Grade 2, in which differentiation ranges from 75 to 50 per cent, and undifferentiation from 25 to 50 per cent; Grade 3, in which differentiation ranges from 50 to 25 per cent, and undifferentiation from 50 to 75 per cent, and Grade 4, in which differentiation ranges from 25 per cent to practically 0, and undifferentiation from 75 to almost 100 per cent. Up to Nov. 1, 1924, complete data had been obtained in 880 instances of graded cases of epithelioma.

Grade	Number	Per cent	Per cent of good results of treatment
1	82	9.31	90.20
2	407	46.25	62.16
3	282	32.04	24.82
4	109	12.38	10.09

Greenough (3) reported, in 1924, a series of cases of breast carcinoma. He made a detailed study of the pathology, especially pleomorphism. Four classes were distinguished, from low to high malignancy. The results of treatment for each class were as follows:

Class	Pathology	Number of cases	Number of cures	Per cent of cures
1	Much differentiation.....	6	4	66
2	Moderate differentiation	19	9	47
3	Slight differentiation.....	43	10	23
4	Highly malignant.....	22	0	0

The relative histological malignancy index was based upon the degree of differentiation and anaplasia, of irregularity in size and shape of nuclei, hyperchromatism, mitoses, and functional activity.

Mahle (4) studied 186 cases of cancer of the body of the uterus with a view to grading the malignancies of the cases according to cellular differentiation. He showed a very direct relationship of longevity to the degree of differentiation. Davis (5) reported the study of microscopic specimens of 38 cases of body cancers from Mahle's viewpoint and found some "striking exceptions." Of six cases in Grade 4, two are living and well three and one-half years and two years, respectively, after operation, and another died of recurrence six

[1]Read at the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 30, 1926.

years after operation. The other three succumbed rapidly to the disease.

In 1923 the writer (6) reported a study of the different cell types found in cervical carcinoma and their varying reactions to radiation. The conclusions were that the spinous cell type was least malignant and least radiosensitive and the fat spindle cell type most malignant and most radiosensitive. Pomeroy and Strauss (7) state that tumors of the uterine cervix belonging to the group of spinous cell type with pearls, and to adenocarcinoma, give promise of better results after radium treatment than do tumors belonging to the other cell groups, namely, the transitional and fat spindle cell types. These views coincide with those of Ewing (8): "It thus appears that the pathological processes in the two classes of tumors—embryonal and adult—are essentially different. A tissue invaded by an embryonal tumor may be restored to a normal state without appreciable scarring, but when the tissue is invaded by a squamous or alveolar carcinoma, that tissue is condemned to extensive scarring or complete destruction." Scarring is accomplished by a high radiation dose. While the tissues of an embryonal tumor are highly radiosensitive, curative results may be obtained without notable damage to normal structures, that is, by small radiation doses.

Plaut (9) states that to-day we have no reliable basis for a histological prognosis in cervical carcinoma. The histological picture does not permit of establishing well defined groups according to the type of cancer cell. Pemberton (10) finds that the order of malignancy of the different cell types progressing from least to most is spinal, adenocarcinoma, transitional, and fat spindle. Hueper, in association with the writer (11), studied the histopathology of 139 cases of cervical carcinoma. The cell types, the differentiation and anaplastic changes of carcinomata were determined. Immaturity of cells, a low degree of differentiation and a high degree of anaplastic changes are invariably associated with a high malignancy index, and the prognosis of the result of radiation treatment is also invariably bad. On the other hand, a high degree of differentiation and a low degree of anaplasia gave a good prognosis of treatment.

The results of the various investigators cited above make it probable that the cell type and the degree of anaplasia and differentiation have a definite value in the determination of the degree of malignancy of a carcinoma, and bear a direct relation to the prognosis of treatment. The clinical extent of a cervical cancer also plays an important rôle in the prognosis of treatment, as stated by Plaut and the writer.

THE DETERMINATION OF THE MALIGNANCY INDEX

Hueper and the writer divided carcinomata of the cervix into two large groups, each having four subgroups:

A. Solid carcinomata
1. Spinous cell with cornification
2. Spinous cell without cornification
3. Round cell
4. Spindle cell

B. Glandular carcinomata
1. Malignant adenoma
2. (*a*) papillary adenocarcinoma
   (*b*) gelatinous adenocarcinoma
3. Adenocarcinoma
4. Solid adenocarcinoma

The classification is based upon the general structure of the tumor and does not refer to the origin of the particular type of cell predominating in the carcinoma. The subgroups of the two main groups do not refer to their origin from any portion of the epithelial layer, but are based upon morphological findings that characterize in a general way their degree of differentia-

tion and their relative proliferative activity. Hueper has attempted to evaluate as many factors as possible in the histological preparations and has given certain numerical values to definite degrees of deviation from the average cell types in the tumor. The following nine factors, which represent differentiation and anaplasia, were given definite numerical values:

1. Special cell type of the carcinoma;
2. Irregularity in size of cells;
3. Irregularity in shape of cells;
4. Distinctness or clearness of outline of cells;
5. Functional activity of cells;
6. Irregularities in the size of nuclei of the cells;
7. Irregularities in the shape of the nuclei of the cells;
8. Hyperchromatism of the nuclei, and
9. Number of mitoses.

The numerical values of the degree of malignancy are:

Spinous cell carcinoma with cornification	2
Spinous cell carcinoma without cornification	4
Round cell carcinoma	6
Spindle cell carcinoma	8
Malignant adenoma	2
Papillary and gelatinous adenocarcinoma	4
Adenocarcinoma	6
Solid adenocarcinoma	8

Irregularities in size and shape of cells and irregularities in size and shape of nuclei were compared with the predominant size and shape in the specimen.

A deviation of 50 per cent from the average was valued	4
An irregularity in 30 to 40 per cent was valued	3
An irregularity in 20 to 30 per cent was valued	2
And an irregularity in 10 to 20 per cent was valued	1

The functional activity of the cells was estimated from the presence of keratin granules and mucous droplets in the cells. If one-half of the cells showed functional activity, the value 1 was given; 30 to 40 per cent, the value 2; 20 to 30 per cent, the value 3, and 20 to 10 per cent, the value 4.

The staining quality of the nuclei was compared with that of the nuclei of the leukocytes. If the former was as intense as the latter, it was considered as hyperchromatism. Twenty-five per cent of hyperchromatism was valued 4; 20 to 15 per cent, 3; 10 to 20 per cent, 2, and below 10 per cent, 1.

Mitoses and prophases were counted in ten fields with the oil immersion lens. If 21 or more mitotic figures were counted in the ten fields, a value of 2 was given; 16 to 20 mitoses, 3; 11 to 15 mitoses, 2, and below 10 mitoses, 1.

The numerical values of the nine factors were determined in 135 cases of cervical carcinoma. The sum of these was termed by Hueper the "histological malignancy index." Table I shows the first page of our ten-page protocol representing a tabulation of the 135 cases included in our investigation. The last two lines were filled in with the aid of the hospital records and after the histological malignancy indices had been determined.

"Clinical result 1" means that the patient was well anatomically and symptomatically three years following the termination of radiation treatment; "clinical result 2," the patient lived for from two to three years; "clinical result 3," the patient succumbed during the second year, and "clinical result 4," the patient did not survive the first year after termination of the radiation treatment. The poor end-result in Case 92 was due to a laparotomy for lipoma of broad ligament and subsequent fecal fistula.

TABLE I

Case Number	950	1318	1344	1397	1639	1584	1627	1661	2327	2294	1626	2366
Special type	8	6	4	8	6	4	8	A8	6	4	6	6
Irreg. in size of cells	3	1	1	2	4	2	2	1	4	2	3	2
Irreg. in shape of cells	4	1	2	3	3	3	2	4	3	3	3	2
Distinctness in outline	4	2	2	3	3	2	3	3	2	2	3	2
Functional activity	4	4	1	4	4	2	4	2	3	4	4	4
Irreg. in size of nuclei	3	1	2	1	4	1	2	1	4	2	4	4
Irreg. in shape of nuclei	3	1	4	3	3	1	1	1	2	1	3	2
Hyperchromatism	4	1	2	2	1	1	1	2	4	1	3	3
Mitoses and prophases	4	4	1	3	1	2	2	1	2	4	1	4
Malignancy index	37	21	20	27	29	18	23	23	30	23	30	29
Clinical group	3	3	2	2	4	3	3	3	4	3	3	4
Clinical result	4	1	2	4	4	1	2	3	3	2	3	3

Table II was made from the whole protocol. It contains the 58 cases with known end-results. These, only, could be used for the study of the prognostic significance of the "histological malignancy index."

TABLE II

CARCINOMATA OF THE CERVIX WITH KNOWN END-RESULTS

1. Protocol number	1	2	3	4	5	6	8	10	12	14	15	16	20	22	24	26	28	29	33	34	36	39	41	42	45	46	47	50	52
2. Cell type	8	6	6	A6	6	6	4	2	6	4	4	6	4	4	A6	A8	6	8	6	2	A6	4	6	8	A8	8	A4	6	4
3. Malignancy index	37	27	32	20	25	27	30	22	21	26	20	26	18	25	18	27	28	27	29	12	16	18	24	23	23	33	22	22	17
4. Group	3	3	R3	R1	3	3	R3	3	3	4	2	3	4	3	3	4	R4	2	4	4	3	3	3	3	3	2	R4	3	3
5. Clinical result	4	4	4	1	2	2	4	2	1	4	2	2	4	3	3	4	4	4	4	2	1	1	3	2	3	4	4	1	2

1. Protocol number	58	60	61	62	63	64	65	66	68	71	73	74	76	77	79	80	82	83	84	93	91	94	92	96	97	98	100	107	111
2. Cell type	8	6	8	6	4	6	6	8	6	A6	A6	6	6	4	6	4	4	6	4	8	2	6	A6	6	6	A6	4	8	6
3. Malignancy index	22	24	26	25	15	27	18	31	26	19	20	21	27	15	30	25	23	30	25	27	17	22	23	23	11	20	10	29	18
4. Group	4	3	3	2	2	3	3	3	3	4	2	2	3	3	3	4	2	4	4	4	3	2	1	4	4	1	3	2	R4
5. Clinical result	4	1	1	1	2	1	1	3	1	4	3	1	3	1	3	3	3	4	3	3	1	1	/4	3	2	1	1	3	4

THE CLINICAL GROUPING OF CERVICAL CARCINOMA

The clinical extent of the cervical carcinoma is determined by a physical examination, including a bimanual vaginal and rectal examination and cystoscopic and proctoscopic examinations. X-ray examinations of the bony skeleton are made to determine absence or presence of bone metastases. Should a patient complain of pain in the kidney region, or should the urine on microscopic examination reveal the presence of pus cells, then functional kidney tests and pyelograms must be made. The results of the examination may be graded into four groups. Each group, also, indicates the methods of treatment which we employ. On the next page will be found a condensed survey.

If Group 1 cases contra-indicate surgery, then radium and X-rays are used.

In a series of 183 cases of primary cervical carcinoma treated with the combined method of radium and X-rays, during the years 1914 to 1920, inclusive, the following results were obtained:

Group	1	2	3	4
Total number	10	21	91	59
5-year healings	8	7	11	0
Per cent	80.0	33.3	11.8	0

The cases belonging to Group 4 have all died from cancer. Hence the statement may be made that a cervical cancer with fixation of tissue and wide extension should not be treated with massive radiations in

PRIMARY CARCINOMA OF THE UTERINE CERVIX

(See page 325)

Group	Physical findings	Indicated treatment
1.	Clearly localized carcinoma	Surgery
2.	Borderline cases with wide and peripheral invasion of the cervix and a doughy consistency of the paracervical region.	Combined use of radium and X-rays
3.	The clearly inoperable cases with invasion of the parametria which are not fixed.	Combined use of radium and X-rays
4.	The terminal cases, characterized by fixation of tissue, invasion of bladder or rectum, and so forth.	Palliative and symptomatic treatment.

the expectation of arresting the growth of the tumor. Such cases offer an absolutely bad prognosis.

THE PROGNOSTIC VALUE OF THE MALIGNANCY INDEX

The prognostic value of the histological malignancy index depends entirely on the end-result; that is, a 3-year or a 5-year healing. Therefore, a comparison of the relation of (1) the clinical grouping, (2) the cell type, (3) the anaplasia, and (4) the malignancy index to the end-result has been made from Table II.

1. The clinical grouping and end-results are shown in the following account:

Clinical group	1	2	3	4
Number of cases	2	10	22	16
End-result 1	1	3	12	0
Expressed in per cent	50.0	30.0	41.4	0

The fact is evident that all the Group 4 cases succumbed to the disease: 62.5 per cent during the first year; 25 per cent during the second year, and 12.5 per cent during the third year. The cell type and the malignancy index did not influence the end-result. This corresponds with the finding in the series of 5-year end-results, given above. The conclusion may be drawn that cases of Group 4 are hopeless, irrespective of cell type and malignancy index.

We shall, therefore, exclude the Group 4 cases in the subsequent discussions.

2. The comparison of the cell type with the end-result is given in the following tabulation:

Cell type	2	4	6	8
Number of cases	2	9	23	8
End-result 1	1	3	12	1
Percentage of End-result 1	50	33.33	52.7	12.5

A proportional relation between cell type and end-result does not exist. The high percentage of End-result 1 in Cell type 6 precludes any possibility of basing the prognosis of carcinoma on the component cell type of the growth.

3. The significance of anaplasia expressed in the end-results:

An interesting point is brought out if the numerical value of the cell type is subtracted from the malignancy index. The resultant value represents the numerical value of the factors constituting differentiation and anaplasia. It may be called the "anaplasia index." A comparison of this index with the end-results yields the following tabulation:

Anaplasia index	Up to 16	17 to 20	21 to 24	25 to 32
Number of cases	19	11	8	4
End-result 1	12	4	1	0
Per cent	63.16	36.36	12.50	0

4. The relation of the histological malignancy index to the end-result is shown in the following tabulation:

Malignancy index	10-20	21-25	26-30	31-40
Average malignancy index	15.67	23.17	26.41	33.33
Number of cases	13	14	11	4
End-result 1	10	6	3	0
Percentage of End-result 1	61.54	42.85	27.27	0

It is seen that a rise in the malignancy index and also the anaplasia index causes a decrease in the number of the 3-year end-results. The same observation also was

made in the series of 5-year end-results based on the clinical grouping. As the local extent of the carcinoma increased, so the number of 5-year healings decreased. A malignancy index above 31 is shown to be 75 per cent within the Clinical result 4, or the worst prognosis, and a malignancy index below 20 is seen to be 61.54 per cent within the Clinical result 1, or best prognosis. A study of these tabulations demonstrates the influence of Group 4 cases and the dependability of the malignancy index for prognosis and treatment of a given cancer case.

The percentages of these tables can be projected graphically. The abscissæ present the percentages and the ordinates the groups, the cell types, and the malignancy index. (See Figure 1.) It is seen that graphs of the 5-year end-results and the malignancy index form almost a straight line—a further proof of the relative importance of the clinical grouping and the histological malignancy index in the prognosis of carcinoma and its correct treatment. The graph representing the cell type, on the other hand, runs an irregular course.

It would require an extended discussion to compare the degree of anaplasia with the malignancy index. The discrepancies occurring in the latter, as, for instance, in Cases 10 and 12 (Protocol number), in Table II, may be explained by the lower index of anaplasia in Case No. 12. A further study also makes it apparent that clinical group 3 cases show a lower percentage of end-results 1—undoubtedly due to the greater extent of the tumor. Examples are furnished by Cases 41, 42, 45, 52 (Protocol number), and so forth.

Two facts stand out prominently: (1) The Group 4 cases, characterized by fixation of tissues and regional lymph gland invasion, give an absolutely bad prognosis. (2) The carcinomata having a malignancy index above 31 also offer the worst prognosis. The clinician will have to consider these two factors in the prognosis and treatment of cervical carcinomata with radiations.

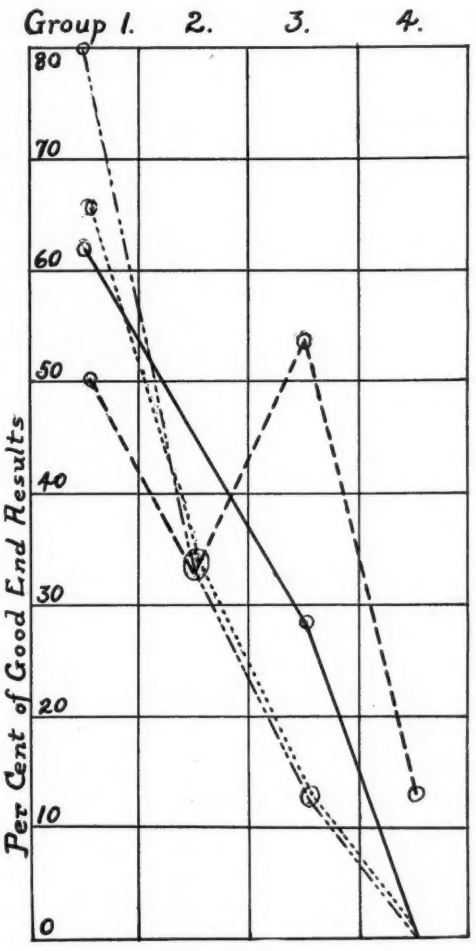


Fig. 1. See text.
- - - - - - - - five-year end-results
——————— malignancy index.
– – – – – – cell type.
. . . . . anaplasia index.

The results reported by Broders, Greenough and the writer may also be plotted, as

seen in Figure 2. Differences between the results of Greenough and the writer are negligible. The better results of Broders may be due to the fact that a much larger number of cases were examined from the standpoint of the degree of differentiation. Broders' and the writer's observations and results agree with the finding of Greenough that high malignancy is shown by cells and nuclei of irregular shape and size without secretory function, and arranged in solid column, large or small, together with numerous and irregular mitoses and hyperchromatism. The extreme degree of these features is pleomorphism. The degree of malignancy of a carcinoma can be determined with a reasonable accuracy by the study of the histology of the original tumor. The method of Hueper, to give to the various factors concerned in anaplasia a numerical value, has the advantage that other investigators may repeat such investigations without giving the histological findings a more or less subjective interpretation. An average of the three percentages in each grade may be taken: For Grade 1 it would be 73 and for Grade 4 it would be 2.7. A line drawn through these two points strikes the percentage 51 in Grade 2 and 25 in Grade 3, which percentages coincide with those of the averages in each grade. This latter line, therefore, expresses the average percentages in each of the four grades and may be called the histological malignancy graph, the averages in each grade being approximately 75, 50, 25, 0.

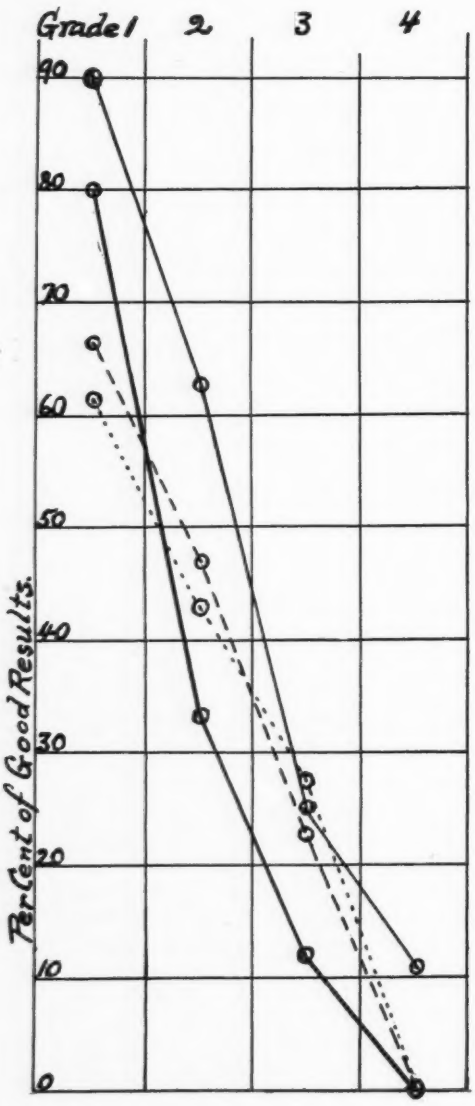


Fig. 2. See text.
————Broders' results.
- - - - - - Greenough's results.
. . . . . malignancy index: Hueper-Schmitz.
————five-year end-results: Schmitz.

CONCLUSIONS

1. The clinical grouping and the histological malignancy index (Hueper) have been described and their prognostic value demonstrated by the good end-results of the treatment.

2. The results obtained by Broders in the grading of carcinomata by the degrees of cell differentiation and undifferentiation, by Greenough in the study of anaplasia, and by Hueper and the writer in the evaluation of cell type differentiation and anaplasia, have been plotted. The graphs show a re-

markably close relation to each other and to the histological malignancy graph. The good results of treatment coincide very well with the histological malignancy graph.

3. X-rays and radium applied to cervical carcinomata should be used according to strict indications. The latter are based on the clinical grouping and the histological malignancy index. Carcinomata which offer a poor prognosis, as determined by the clinical grouping and the histological malignancy index, should not be treated with radiations. Carcinomata of all other groups and grades give every hope of being arrested by the combined application of X-rays and radium. However, the more extended the disease is and the higher the malignancy index rises, the fewer are the good end-results obtained.

REFERENCES

1. Martzloff, K. H.: Carcinoma of the Cervix Uteri. Johns Hopkins Hosp. Bull., 1923, XXXIV, 141-149; 184-195.
2. Broders, A. C.: The Grading of Carcinoma. Minn. Medicine, 1925, 726-730.
3. Greenough, R. B.: Varying Degrees of Malignancy in Cancer of the Breast. Jour. Cancer Research, 1925, IX, 453-463.
4. Mahle, A. E.: Morphological Histology of Adenocarcinoma of the Body of the Uterus in Relation to Longevity. Surg., Gynec., and Obst., 1923, XXXVI, 385.
5. Davis, L.: Carcinoma of the Body of the Uterus. Ann. Surg., 1925, 131.
6. Schmitz, Henry: Action of Measured Radiation Doses on Carcinoma of the Uterine Cervix. Am. Jour. Roentgenol. and Rad. Ther., 1923, X, 781-792.
7. Pomeroy, L. A., and Strauss, A.: Carcinoma of Cervix Uteri. Jour. Am. Med. Assn., 1924, LXXXIII, 1060-1062.
8. Ewing, James: The Influence of Radiation Therapy on the Study of Cancer. Canadian Practitioner, 1924, XLIX, 95-104.
9. Plaut, A.: The Relation of Prognosis to the Histological Findings in Carcinoma of the Cervix. Surg., Gynec. and Obst., 1926, XLIII, 450-458.
10. Pemberton, F. A.: The Relation between Treatment of Cancer of the Cervix and the Cell Type. Am. Jour. Obst. and Gynec., 1926, XII, 536-543.
11. Schmitz, H., Hueper, William, and Arnold, L.: The Significance of the Histological "Malignancy Index" for Prognosis and Treatment of Carcinomata of Cervix Uteri. Am. Jour. Roentgenol. and Rad. Ther., July, 1926, XVI, 30-42.
12. Schmitz, Henry: The Classification of Uterine Carcinoma for the Study of the Efficacy of Radium Therapy. Am. Jour. Roentgenol. and Rad. Ther., 1920, VII, 383-393.

DISCUSSION

Dr. Hermann Wintz (Erlangen, Germany): There is no doubt but that it would constitute a most important result, if it should become possible to draw from the histological findings of a carcinoma certain conclusions as to the healing process. Dr. Schmitz' results seem in that respect most outstanding, but the problem is not yet solved.

I have also tried for many years to find a relationship between the microscopic picture and the prognosis.

So far, it is certain that the adenocarcinoma shows a lower sensitivity than the flat celled epithelioma. Observations extending over several years have proved that the difference in sensitivity amounts to 25 per cent, this figure referring to the U.S.D. (Unit Skin Dose). This knowledge prompted me to treat the adenocarcinoma of the cervix and the uterus with 120 to 125 per cent of the U.S.D. As it is very difficult to reach this amount with X-rays only, I use an additional dose of radium in these cases.

The differentiation between immature, half mature, and fully mature carcinoma did not offer any practical results for the prognosis and treatment with X-rays. The immature carcinoma is an expression of accelerated growth, therefore it is also more sensitive to X-rays. By this fact, the clinical malignancy is held back.

The question of inflammation seems of far greater importance. With cases of carcinoma of the portio which come for treatment, more than two-thirds are purulent and ichorous. Different microbes may be found causing the infection: streptococci are

found in about 35 to 40 per cent of the cases. From the standpoint of clinical conditions as well as X-ray treatment, the occurrence of streptococci becomes important if the virulence is increased by secondary factors, such as stases, necroses, and blood-clots. Highly pathogenic organisms are found in only about 15 to 20 per cent of the cases.

The importance of inflammation becomes emphasized by the fact that, when inflamed, the carcinomatous cell becomes more sensitive to impairment by X-ray. Whatever the reason may be, it is proved by experiments that carcinoma, infected with streptococci, cannot be made to disappear by a dose of 110 of U.S.D.

The deleterious influence of the inflammation proceeds further. Not only is the sensitivity of the carcinomatous cell decreased to X-ray, but the sensitivity of the surrounding connective tissue is actually increased. It follows, therefore, that carcinoma infected with streptococci holds out an especially unfavorable prognosis.

From this it may be concluded, as a matter of fact, that this type of carcinom should first be treated with antiseptic measures. For this purpose I use mainly antiseptics by deep application, primarily, the copper treatment. This is deeply applied by electrolysis or kataphoresis. The results have been progressively improved by systematic application in use for nine years.

Dr. Albert Soiland (Los Angeles, California): The average clinician who has not the facilities of an institution such as both Dr. Schmitz and Dr. Wintz possess has not much chance to absorb all of these wonderful ideas that have been presented, because he has not the place to develop the thoughts that are brought to him in a meeting such as this. There is no question as to the value of the attempt at differentiation of malignancy, as Dr. Schmitz has propounded it, and I really think that his next five-year result, based on this present five-year classification, will show a much higher ratio of good results than the one ending in 1920. There is one element we have to consider, which from the clinician's standpoint is really the most important. In the differentiation of the cases, not only the cell type or grade of malignancy, but the general condition of the patient must be seriously considered and correlated, in order to take full advantage of the malignancy index system as outlined by the essayist. This demands the good judgment which comes to every medical man and woman by years of observation only, and experience with the different types of treatment for these conditions. I shall be very glad to have the opportunity to hear Dr. Schmitz at a future time give his results under this classification of malignancy index, and I think it will be a better showing even than he has given us to-day.

Dr. H. J. Ullmann (Santa Barbara, California): I wish to invite your attention to the use of the basic or alkaline diet by Dr. Kaplan, especially citrus fruits, in preventing radiation sickness. We reported the use of a basic diet in Radiology some time ago. I believe that if these patients were placed on this diet for several days before radiation treatment was commenced, there would be still less sickness. It is essentially a meat-free, egg-free, bread-free diet with accentuation on the citrus fruits. One finds that most of these patients have a urine pH. of 5 or less when first seen and if this were raised to 7 or more before treatment was commenced, there would be very little roentgen sickness. Some patients can not tolerate the citrus fruits and in these cases reliance must be placed on foods such

as bananas and potatoes. Tables giving the relative value of different foods from the acid-base standpoint can be found in our paper.

DR. SCHMITZ (closing): I wish to thank Dr. Wintz and Dr. Soiland for the very kind discussion of my paper. Besides the histological malignancy index and the clinical grouping according to the extent of the carcinoma, additional factors must be considered to arrive at a relatively correct prognosis of a given cancer case. As such additional factors may be mentioned: blood and urine examinations and chemical blood tests and blood serum examinations. The last two give especially interesting interpretations for the prognosis or treatment of cancerous disease. Such investigations were published by us in 1924. The following summary gives the evaluation of these researches: (1) Radiation sickness is caused by the absorption of autolytic products from the degenerative areas of the tumor mass. This intoxication is an example of a "nonspecific" reaction. (2) The blood sera of patients with carcinoma become carcinomalytic after treatment with radium and roentgen rays, as evidenced by the Freund-Kaminer reaction. (3) The results of the chemical and serum examinations of the blood of carcinoma patients with extensive and necrotic cancer tumors should be subjected to radiation therapy with a great deal of caution, using preferably a fractional interval method to prevent severe radiation intoxications. Patients with advanced carcinoma should not be subjected to radiation therapy.

It, therefore, would appear that further investigations along the lines mentioned, that is, histological malignancy index, clinical grouping, chemical and serum blood analyses, would aid us materially in the determination of the proper method of treatment and a relatively correct prognosis of the disease and of the treatment of carcinoma.

Dr. Kaplan gave a careful review of his work in radium therapy of uterine carcinoma. However, a clinical grouping of the cases as observed in our clinic and adopted by other clinicians, notably Ward and Farrar, John G. Clark, Bailey and Healy, Kelly, Burnam and E. Ward amongst others, would render comparison of results much more profitable to the medical profession.

DR. KAPLAN (closing): In answer to Dr. Ullmann's question about the alkalinity, we follow his diet somewhat. Due to the fact that Bellevue is a municipal hospital, eggs are rare there unless the patients bring them in themselves. Meat is usually not very good, so most patients do not eat meat. Potatoes are given in profusion, and that perhaps is what is helping our patients, but I find that the orangeade and lemonade are borne very well by the patients and help them a great deal. Dr. Schmitz took exception to my graphic sketch; that was just an offhand picture, showing our working method. In the grouping, we follow the plan, somewhat as Dr. Schmitz has suggested. But if he will remember, all our cases are involved cases; they are cases sent to us from other clinics or other doctors that are too far gone to do anything with but palliation, and therefore this is a short graphic picture of how we regulate the amount of dose we use. Now, about the dosage over a long period of time. Our dosage extends about ten days for the X-ray and about seven or eight days for the radium—a period of eighteen to twenty days—and, in spite of that, in some cases we still get radiation sickness. In order to follow out the suggestion Dr. Pfahler made recently, of saturation, we do increase the dose; in

many of our cases we give an extra dose of X-ray and a larger dose of radium so as to make up for the loss of radiation due to the stretching over so long a period of time.

Treatment in shock.—Acute gastric dilatation may be seen accompanying or following any condition in which shock is present. Shock may be produced by operative procedures or it may be brought about as a result of traumatism. Gastric dilatation is also frequently seen as a complication of a severe infectious disease such as pneumonia. The cause of acute gastric dilatation has always been obscure. The symptoms are quite constant. The most prominent symptom is vomiting; it comes on early and lasts throughout the course of the disease. From operative observations the author feels that compression of the third portion of the duodenum at its junction with the jejunum by the mesentery or the mesenteric vessels plays an important part in bringing about this condition. Placing the patient upon his abdomen and elevating the head of the bed tend to relieve the condition.

He summarizes as follows:

"The experience of a number of those who have dealt with acute gastric dilatation in practice or by experimentation, as well as that of the author, leads to the following conclusions:

"1. Acute dilatation of the stomach comes about as the result of compression of the third portion of the duodenum by the mesentery and the superior mesenteric vessels.

"2. It never occurs unless there is first present atony of the duodenum.

"3. It occurs in its milder form quite frequently and usually goes unrecognized.

"4. A knowledge of the mechanics involved will aid in an earlier recognition of the condition and therefore a more rational régime as regards its prevention and treatment.

"5. Any patient who has been subjected to shock should not be allowed to remain face upward in bed for any considerable length of time.

"6. Pre-operative purgation and post-operative administration of morphine are to be avoided as much as possible.

"7. If surgical measures become necessary duodeno-jejunostomy is anatomically and physiologically the operation of choice."

L. R. SANTE, M.D.

Compression of Duodenum by Mesentery and the Superior Mesenteric Vessels—An Underlying Cause of Acute Gastric Dilatation. Leith H. Slocumb. Surg., Gynec. and Obst., March, 1927, XLIV, 359.

CASE REPORTS

A CASE OF CALCIFIED THYROID

By ROBERT A. ARENS, M.D., and ARTHUR R. BLOOM, M.D., Roentgenologist and Assistant Roentgenologist, Respectively, of Michael Reese Hospital, CHICAGO

Calcification of an entire lobe of the thyroid is comparatively rare. A search of the literature for the past ten years reveals only two cases listed as such. Clark described a case in the *Southern Medical Journal* of 1920. His patient had had symptoms of hyperthyroidism for ten years, but came to him complaining of a hard tumor in the midline of the neck. On X-ray examination it was shown to be a calcified thyroid.

The other case was described by Pennel in the *Lancet* of 1917. His patient came to him seeking medical advice for aphonia, which had existed for three months. On physical examination a small hard lump about the size of a walnut was found on the left side of the neck, occupying the position of the left lobe of the thyroid. No radiological examination was made and a diagnosis of carcinoma of the thyroid was made. On operation, a craggy mass of rock-like consistency was found, which proved to be a calcified adenoma. The author believed it to be a calcified parathyroid.

Kaufman states that small areas of calcification of the thyroid are frequently seen, and adds that complete calcification of the thyroid or its capsule may occur, intimating that it is not frequent. The illustration in his book resembles our case very closely.

It is because of the relative paucity of the literature on this subject that we are reporting the following case.

G. J., aged 67, a patient of Dr. Alfred A. Strauss, entered the hospital complaining of abdominal distress after meals, loss of appetite, indigestion, belching, and nocturia.

Fig. 1. Calcified left lobe of thyroid, with deviation of trachea to right.

The physical examination revealed only epigastric tenderness. There was nothing in the history to indicate any involvement of the thyroid gland. He had no symptoms of hyperthyroidism or mediastinal pressure, and no enlargement of the cervical region was noted. He was sent to us for a gastro-intestinal roentgen-ray examination. An ulcer of the duodenum and one of the lesser curvature of the stomach as well as a pathological gall bladder were found. However, while routinely fluoroscoping the chest, a calcified mass was found in the left cervical region. A film of that area showed the mass to be a calcification of the left lobe of the thyroid. The trachea was deviated to the right and showed compression (Fig. 1). The patient was not operated on.

This case, in contradistinction to the other two mentioned above, had no symptom re-

ferable to the thyroid and was found accidentally in the course of a routine examination.

BIBLIOGRAPHY

1. Pennel, V.: Lancet, March 24, 1917, I, 459.
2. Clark, J. J.: Southern Med. Jour., March, 1920, XIII, 183.

AN INGUINAL GRANULOMA OF UNKNOWN ORIGIN ASSOCIATED WITH BONE CHANGES

CASE REPORT

By JOHN R. CARTY, M.D., Chief, Clinic of Roentgenology, Cornell University Medical College, NEW YORK

The patient, a young clerk 31 years of age, was referred for treatment of a granuloma of both inguinal regions. The groins were occupied by a mass of exuberant granulating tissue, with a foul smelling exudate. The lesions extended laterally to the wings of the ilia.

In 1915 the patient had a bilateral inguinal adenitis. At this time a biopsy was performed. The lymph node showed chronic inflammation due to some infection. Between 1916 and 1920 the patient resided in Shanghai, China. In 1921, he developed a rather severe backache, for which he received orthopedic treatment, which consisted chiefly in wearing a steel brace for a year. The past history is irrelevant. The patient is married and has one child, who is perfectly healthy.

The lesion began a year and a half ago as a hard, painless verrucous plaque in the right inguinal region. This began to break down centrally and a similar condition developed on the left side.

Physical examination showed a rather pale young man. The general physical examination was negative except for the local lesions and some limitation of motion in the lower back. A rectal examination showed massive perirectal infiltration, with involvement of the rectal walls. The latter were hard and infiltrated and the mucous membranes showed granulomatous patches.

Following the onset of the lesions an extensive and careful study of the patient was made by many competent observers. The dermatologists who saw the lesion were unable to classify it. Repeated biopsies of the lesion showed chronic granulomatous tissue and the pathologists did not suggest a diagnosis. Examination of a piece of tissue taken from the rectum showed the same pathological picture.

Fig. 1. The lesions after treatment. There is deep pigmentation of the healed areas.

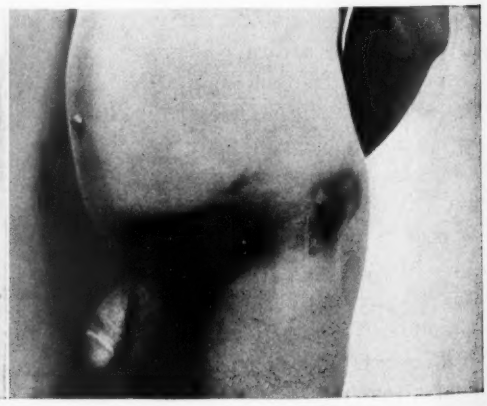


Fig. 2. Note the lateral prolongation of the lesion, which is quite flat here.

The blood Wassermann was negative on several occasions. The blood count showed a slight anemia, otherwise it was negative. Examination of the stools for ova and parasites was negative. Vigorous antiluetic treatment produced no effect. Potassium tartrate likewise produced no effect.

Just before starting X-ray treatment a complete radiographic study of the bones was made, with the following findings: There was a marked destruction and production of bone, with the destruction predominating. There were clear-cut areas of destruction surrounded by an area of increased density. The sacrum, wings of the ilia, and the transverse processes of the vertebræ were chiefly involved. There was some involvement of the bodies of the fourth and fifth lumbar vertebræ and of the last rib on the right. The bone production was seen chiefly in the transverse processes, where, in one case, there was an almost complete bony bridge formed with the vertebra above. Six months later another radiographic study was made, which showed an extension of the process to the right ischium. A recent radiographic study of the bones showed no appreciable change. A film of the chest was negative.

X-ray therapy, consisting of eighteen medium wave aluminum-filtered treatments, was given at three-week intervals to both inguinal regions. There were two rest intervals of eight weeks. Following the first two treatments the exudate disappeared and a steady improvement was noted. The lesions flattened out. As the lesions healed, the affected areas became deeply pigmented. A recent rectal examination showed no infiltration of the rectal walls. Although the pain in the back is still present, the general health of the patient is much improved.

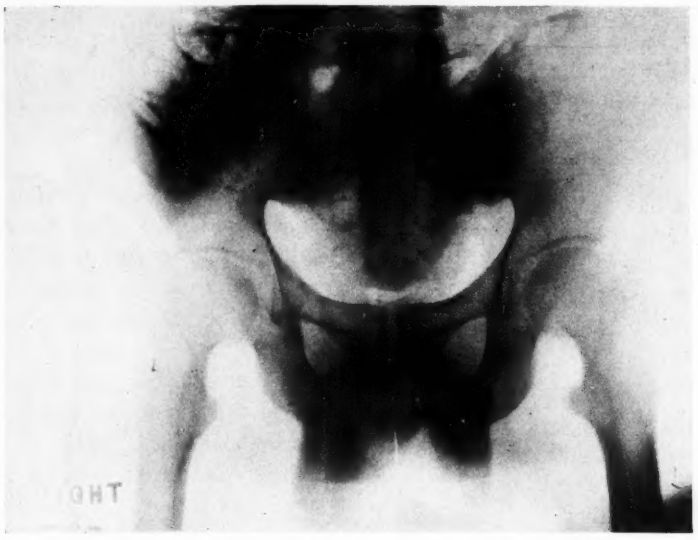


Fig. 3. Note the clear-cut areas of destruction in the right ilium.

SUMMARY

An extensive granuloma of the inguinal regions of doubtful origin in a young man, associated with marked soft tissue infiltration of the pelvis and an atypical bone involvement. The soft tissue lesions resisted antiluetic treatment but responded well to X-ray.

EDITORIAL

NEW METHOD OF TREATING ASTHMA BY RADIATION

Radiation has been tried for asthma by many workers in various parts of the world, but the results, judging from the literature on the subject, appear unsatisfactory.

For several years I have been working on a special technic for treating cancer by radiation at the London Hospital. It was while on this investigation that I quite accidentally found that the method had a very remarkable effect on asthmatical patients.

I have treated a number of cases of asthma of all types and there is no getting away from the fact that in really bad cases the results are spectacular, and, as far as time allows, the beneficial results are permanent. The milder cases all respond equally well. When, however, bronchitis is predominant, while the attacks of asthma will be relieved, for which the patients will be thankful, generally speaking the bronchitis itself is but little affected.

I wish to draw attention to this method for two reasons. If it is correctly followed out, it will lead to the relief of a large army of sufferers from this distressing complaint. In addition, it may result in light being thrown on the cause of asthma, which, after all, is but a symptom of disease. It is apparent from this last observation that I am ignorant as to how the beneficial results are being obtained. But I suspect, for three reasons, that radiation has some influence on the ductless glands. In other words, some metabolic effect is produced. These reasons are: (1) Beneficial results can be obtained by radiation of the abdomen only —that is, excluding the thorax. (2) Increase in body weight is in many cases remarkable. (3) There is a general feeling of well-being experienced by most patients very soon after treatment has commenced.

The question as to whether radiation sickness is due to some metabolic upset is not yet settled.

A preliminary note of the technic used has already appeared in the *British Medical Journal* for June 5, 1926. However, a brief description of the method will be given here so that others may give it a trial. Let me, however, emphasize the importance of following out the technic in every detail; the results otherwise will be unsatisfactory—even damage may be done to the patient. I know of a colleague who overdosed to such an extent that several of his patients died, cured of their asthma! This method has two important features, differing from radiation as applied by other workers:

1. Large radiation field.
2. Small dosage.

1. By a *large field* I mean the whole trunk, extending from the chin to the symphysis pubis. The abdomen, however, is the important area. I place a Coolidge tube at the back and front of the patient—both energized at the same time by two separate installations, so arranged that the whole trunk, back and front, is included in the radiation field. While time is saved by this dual installation, the results are just as good if the front and back of the patient are

radiated separately. The tubes are centered over the epigastrium and over a corresponding point posteriorly.

2. *Small dosage* is very important. The high voltage technic is quite unsuitable and even dangerous over such a large area. The voltage should not be above 70,000. Spark gap (points) 25 cm. A filter of 3 mm. of aluminium is used. The skin dose is 10 to 15 *X*. Personally, in addition to any indirect measurement of X-ray output, I use Sabouraud pastilles as my unit for direct measurement in every case. These pastilles are placed *on the skin,* a tintometer being used to read the correct tint (about ¼ *B* tint for 10 *X*). With 8 ma. through the tube, this should take but 5 to 8 minutes for 10 and 15 *X*, respectively.

The first cases attempted should be those without chronic bronchitis. Broadly speaking, there are three classes of asthma:

1. True asthma with occasional attacks of bronchitis.

2. Chronic bronchitis with occasional attacks of asthma.

3. Cardiac asthma.

The last do not respond to radiation, although but few cases have so far been treated. This treatment is given twice weekly in bad cases and once weekly in average cases, four to six being the course. If the patient gets wheezy after the course, he is told to report at once, as an occasional dose may be necessary. No blood changes of any note occur and only slight nausea in a few patients.

I hope to publish a rather fuller account later, but I am anxious that other radiologists should try out the method as soon as possible.

The same technic might prove of value in cases of whooping cough, but in this country it is difficult to get hold of these cases in any number.

I should much appreciate a note on the results obtained and any phenomena noticed during or after the treatment from any radiologist who becomes sufficiently interested to take up the subject. There is a vast amount of work to be done on the effect of small doses of radiation administered to the whole trunk.

S. Gilbert Scott,
M.R.C.S., L.R.C.P., D.M.R.E, (Camb.), *Medical Director of the Radiological Department of the London Hospital.*

THE WASHINGTON CONFERENCE OF THE AMERICAN COLLEGE OF RADIOLOGY

The Fourth Annual Meeting of the Chancellors of the American College of Radiology took place at Washington, D.C., May 17, 1927, the following officers and Chancellors being present:

Edwin C. Ernst
Alfred L. Gray
Preston M. Hickey
M. J. Hubeny
Benjamin H. Orndoff
Henry K. Pancoast
George E. Pfahler
Douglas Quick
Albert Soiland
Rollin H. Stevens
I. S. Trostler
W. Walter Wasson

At the Convocation retiring President Hickey escorted M. J. Hubeny, the incoming President, to the Chair. Dr. Hubeny pledged himself to the building up of the principles for which the College stands, in the manner provided by the Constitution and By-laws. President Hubeny then introduced the President-elect, Alfred L. Gray, who made a scholarly address. He pledged his support to President Hubeny in every way which might redound to the credit of the College.

The Board of Chancellors have created eight new Fellowships, as follows:

F. H. Baetjer
Curtis F. Burnam
A. C. Christie
Clyde O. Donaldson
John F. Herrick
W. A. LaField
James M. Martin
Charles A. Waters

In addition to the election of Alfred L. Gray, Lloyd Bryan was elected Vice-president, Benjamin H. Orndoff was re-elected Treasurer, and I. S. Trostler, Historian.

The following Honorary Fellows were nominated and elected:

A. Béclère, of Paris
William D. Coolidge, of Schenectady, New York
William Duane, of Harvard University.
Fedor Haenisch, of Hamburg
Severin Heyerdahl, of Oslo
Guido Holzknecht, of Vienna
Axel Reyn, of Copenhagen

The following definition of "radiology" was proposed and accepted: "Radiology is that branch of medical science which deals with the use of radiant energy in the diagnosis or treatment of disease."

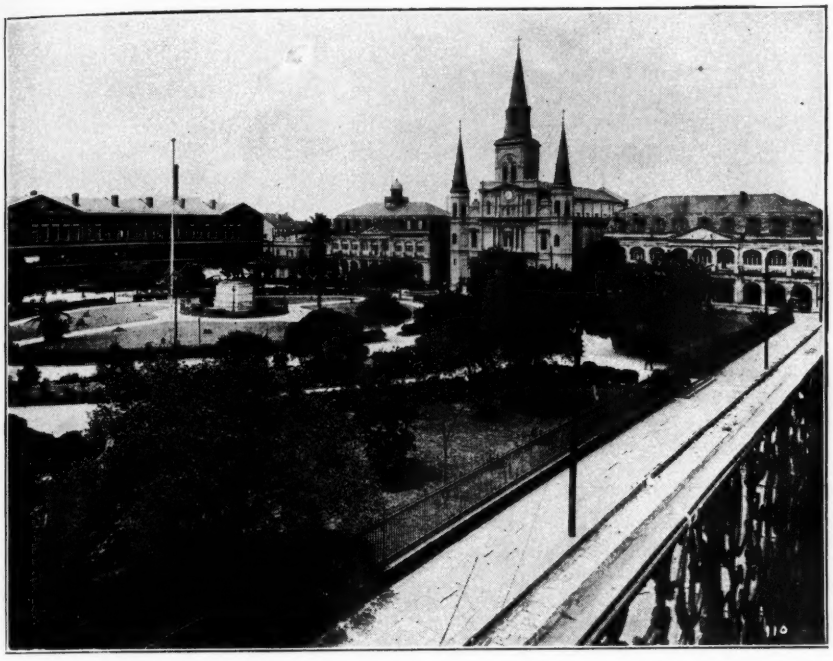
The first Gold Medal awarded by the College was presented to Dr. William D. Coolidge, whose modest response was phrased in beautiful language which will not soon be forgotten by those fortunate enough to hear it.

The roll call at this most successful session was responded to by the following Fellows:

Frank S. Bissell
Curtis F. Burnam
James T. Case
D. S. Childs
A. C. Christie
William D. Coolidge
B. C. Cushway
J. C. Dickinson
William Duane
Edwin C. Ernst
Arthur W. Erskine
William A. Evans
Alfred L. Gray
G. W. Grier
John F. Herrick
Preston M. Hickey
M. J. Hubeny
Byron H. Jackson
U. S. Kann
Robert H. Lafferty
L. T. LeWald
R. E. Loucks
Robert J. May
John F. McCullough
R. H. Millwee
A. B. Moore
W. S. Newcomet
B. H. Nichols
Benjamin H. Orndoff
Henry K. Pancoast
D. T. Quigley
F. H. Rodenbaugh
Edward W. Rowe
E. C. Samuel
Henry Schmitz
Albert Soiland
R. H. Stevens
William H. Stewart
L. F. Talley
I. S. Trostler
Henry J. Ullmann
W. Walter Wasson
Charles A. Waters
William C. Wescott

JOHN G. WILLIAMS, M.D.

Dr. Williams, whose death occurred July 2, 1927, at his home in Brooklyn, New York, at the age of 54, was a specialist in roentgenography and a pioneer in Brooklyn in the development and use of deep X-ray



Jackson Square, New Orleans. Originally the Place d'Armes, with the passage of the years its name has been changed to prosaic Jackson Square. It is regarded by many travellers as one of the most charming squares in any city.

Those who attend the Annual Meeting of the Society in New Orleans, Nov. 28–Dec. 2, will have the opportunity of seeing this and other places of historic interest.

therapy. A native of Branford, Connecticut, Dr. Williams was graduated from the Yale Medical School in 1900. He served his interneship at St. Mary's Hospital, Brooklyn, and throughout the remainder of his career was a member of its staff. At the time of his death he was attending roentgenologist and President of the Medical Board. He was a consulting expert to Brooklyn Hospital, and at various times served on the staffs of numerous leading hospitals in his home city. He established what is said to have been the first clinic in the city employing deep X-ray therapy. He was a former President of the New York Roentgen Ray Society, and member of the Radiological Society of North America and American Roentgen Ray Society.

GENERAL AND SUB-COMMITTEES

FOR THE ARRANGEMENT OF THE ANNUAL MEETING OF THE RADIOLOGICAL SOCIETY OF NORTH AMERICA IN NEW ORLEANS

EXECUTIVE COMMITTEE

Dr. Amédée Granger, *Chairman,*
Dr. E. C. Samuel, *Treasurer,*
Dr. E. R. Bowie, *Secretary,*
Dr. L. A. Fortier,
Dr. T. T. Gately,
Dr. L. J. Menville.

SCIENTIFIC SESSIONS AND CLINICS

Dr. Leon J. Menville, *Chairman,*
Dr. S. C. Barrow, of Shreveport,
Dr. L. A. Fortier, of New Orleans.

SCIENTIFIC EXHIBITS

Dr. Ernest C. Samuel, *Chairman,*
Dr. T. I. St. Martin, of Houma,
Dr. H. G. F. Edwards, of Lafayette.

HOTELS AND REGISTRATIONS

Dr. T. T. Gately, *Chairman,*
Dr. Lester J. Williams, of Baton Rouge,
Dr. C. P. Rutledge, of Shreveport.

ENTERTAINMENT

Dr. L. A. Fortier, *Chairman,*
Dr. T. I. St. Martin, of Houma,
Dr. Mozart Rainold, of Pass Christian.

COMMERCIAL EXHIBITS

Dr. E. R. Bowie, *Chairman,*
Dr. G. C. McKinney, of Lake Charles,
Dr. C. P. Rutledge, of Shreveport.

LADIES' COMMITTEE

Mrs. Amédée Granger, *Chairman,*
Mrs. E. R. Bowie,
Mrs. L. J. Menville,
Mrs. E. C. Samuel,
Mrs. Mozart Rainold.

LOCAL PROFESSION

Dr. Paul Gelpi, *Chairman,*
Dr. Kotz Allen,
Dr. M. E. Brown,
Dr. S. M. Blackshear,
Dr. Charles C. Chassaignac,
Dr. O. C. Cassegrain,
Dr. M. Couret,
Dr. J. T. Crebbin,
Dr. F. J. Chalaron,
Dr. Homer Dupuy,
Dr. Jules Dupuy,
Dr. J. T. De Grange,
Dr. Val. Fuchs,
Dr. M. J. Gelpi,
Dr. J. B. Guthrie,
Dr. F. R. Gomila,
Dr. R. L. Gordon,
Dr. W. M. Harris,
Dr. R. B. Harrison,
Dr. F. M. Johns
Dr. Louis Levy,
Dr. Lucien Ledoux,
Dr. Jerome Landry,
Dr. R. C. Lynch,
Dr. E. L. Leckert,
Dr. Urban Maes,
Dr. T. A. Maxwell,
Dr. M. O. Miller,
Dr. J. T. Nix,
Dr. W. D. Phillips,
Dr. W. H. Robin,
Dr. E. J. Richard,
Dr. William Simon,
Dr. George Taquino,
Dr. Charles V. Unsworth.

OWNERSHIP OF ROENTGENOGRAMS AND HOSPITAL RECORDS[1]

Careful search has failed to reveal any case in which a court has decided whether a person who is roentgenographed is, in the absence of an express agreement, entitled to the resulting roentgenogram. A somewhat similar question has been decided, however, with respect to the right of a person photographed to the photographic negatives incident to the process. Courts have held that the negative is the property of the photographer, subject to certain restrictions on its use.[2] But the parallel is not perfect; every one knows that a person who presents himself to a photographer to be photographed expects to receive a photograph and does not expect to receive any intermediate product of the process of manufacture, but it is not clear whether a person who presents himself to be roentgenographed expects to receive, and the roentgenologist expects to give, an opinion and advice, or a

[1] Reprinted by permission from *Journal of American Medical Association*, June 18, 1927, p. 1985.

[2] Corliss et al. v. Walker Co. et al., 64 Fed. 280. Pollard v. Photographic Company, 49 Ch. Div. 345.

roentgenogram, or both. In the absence of an express agreement, a court that is called on to determine the question will try to find out what was in the minds of the parties to the transaction at the time it occurred. To that end it must look for proof of a reasonably definite and generally recognized understanding among roentgenologists and their patrons with respect to the matter.

Proof of any understanding whatever among the non-professional public would probably be difficult. Persons of this class are referred to roentgenologists, present themselves for examination, and await the reports of the results, which they receive through their physicians; they do not stop, before being roentgenographed, to ask whether or not they are going to receive roentgenograms. Among roentgenologists and physicians generally, however, a common understanding is more readily susceptible of proof. A formal statement of that understanding by a representative professional group is to be found in resolutions adopted in 1920 by the Radiological Society of North America. There it is expressed as the sense of the Society that all roentgenograms, plates, films, negatives, photographs, tracings or other records of examination are the exclusive property of the roentgenologist who made them or of the laboratory where they were made. The roentgenologist is declared to be a professional man, whose opinion and advice are sought; he is not a mere technician, paid to make a certain kind of photograph called a "roentgenogram." He is a consultant in all cases in which he is called on to examine patients; therefore he is not to make known to a patient or to a patient's relatives, friends or guardian any of his observations or conclusions. He is not to deliver to any of them any plate, negative, film or print unless requested so to do by the physician who referred the patient for examination or who is in charge of the case. Evidence showing a general acceptance by the profession of the principles laid down in these resolutions will go a long way, in the absence of an express agreement, toward settling the question of the ownership of the roentgenogram, if and when that question comes before the courts.

The fact that a roentgenogram was made by a hospital, through its roentgenologist, and not by a roentgenologist acting for himself, does not alter the situation just stated, except that it makes a stronger case for the retention of the roentgenogram by the hospital. A hospital may make such reasonable regulations as are necessary for its efficient management. If any such regulation is in fact brought to the attention of a patient or a physician using the hospital, or if he has actual knowledge of that regulation, before he enters on such use, he is bound by it. The fact that the regulation is posted in and about the hospital or even that it has been customarily followed for a long time would tend to prove such knowledge on the part of a physician or a patient and to bind him accordingly. If any such regulation requires that the records, including roentgenograms, remain in the hospital, it would presumably be sufficient to compel a physician or a patient to leave his case records there, including roentgenograms.

Whether a patient may as a matter of right inspect his hospital records, including any roentgenogram that may form a part of it, or may have that record inspected on his behalf, or may make a copy of it or have a copy made, and whether he may require the hospital to provide him with a copy of the record on tendering the cost of making it, are questions that the courts have apparently not been called on to decide. If such questions are fairly presented, a court may not unreasonably hold that a patient is entitled to make such an inspection or to have it made, under conditions that do not interfere with the orderly operation of the

hospital. It seems not unlikely, too, that the court may hold that a patient is entitled to a copy of this hospital record so far as it is necessary to his welfare, at least on payment of the cost of preparing the copy. The fact that these various questions have never been carried to the courts of last resort and possibly to no other courts suggests very strongly that they are usually settled by the parties on the basis of equity and common sense—which, after all, is the very best way to settle them.

USE YOUR OWN JUDGMENT

THE USE OF CATHARTICS[1]

To the Editor:—I appeal to the fountainhead of medical knowledge [in this case, the Editor of the *Journal of the American Medical Association*] for information on a subject of greatest personal and community importance. Shall I take a physic? And shall I give a physic to practically all my patients? I have not taken a physic for more than fifteen years and am in perfect health. My intestinal exit operates as faithfully as the inlet, with an almost unvarying ratio of one to three. Traffic occasionally slows up a bit and as a consequence terminal unloading facilities may be put to some test, but this is never extreme and there have been no failures nor needed repairs. Once in a long time I have a cold but in no instance has a cold ever slowed up deliveries. Years ago I always took a physic for my colds, which always did two ugly things to me: They always gave me a bellyache and disturbed my regular evacuating habits. My colds without physics are just as brief as those subjected to the foregoing complications.

Now as to my patients. They all want a "thorough cleaning out" and a change in diet. Advances in scientific medicine and a group of diet trade journals have put a lot of discontent in the minds of my patients about what they should eat in order to be able to live, and, as the last congress adjourned without providing any new foods, I am frequently distressed with my inability to supply new formulas and combinations; but I am not now asking for any relief in this particular. However, I do want enlightenment on the contention that if the patient suddenly shows a little fever or a subnormal temperature, or restlessness, or tympanites or a collapsed abdomen, or frequency of bowel movements or a total stoppage, or numbness of the first three fingers on the right side, or anorexia, or a gluttonous appetite, or nausea, with or without vomiting, or a sudden dislike for the male parent, that such a patient should at once have a physic. And if so, what? and when? and how long?

A new treatise on skin diseases just came to my notice, and, in going through it in a quick review my memory may not serve me perfectly, but I can now recall just one condition that did not require a "purge," a "physic" or a complete overhauling of the entire eliminating machinery, and that was freckles. I was pleased, as I have freckles and it may be safe to go right on neglecting my bowels as heretofore with safety. I have no more trouble keeping my bowels regular than my nose Roman, and I have about come to the conclusion that, colds or no colds, I need plastics for my nose just as frequently as physics for my bowels, and that's that.

Such limited reading of last editions as I do gives me scant support for my aversion to purges and "thorough cleaning out of the intestinal tract." My frequent contact with physicians convinces me that I do far less cleaning out than they do, and when it comes to toning up a liver with laxatives I

[1]Reprinted by permission of the author and the editor from the *Journal of the American Medical Association*, May 28, 1927, p. 1747.

am almost a total failure. I try. In this community one simply must be able to do considerable in the way of toning up livers. It seems that we live in the toneless liver belt; and since Marshall Field established that the customer is always right, we must tone 'em up as per general request, or they will get another toner. I do not know whether the people or the physicians established this belt, but it's here all right and we live in the center of it. It is not without its advantages as I am planning to send both of my girls away to school, but I am losing confidence in my toning abilities. At a recent meeting of our society I informed my confrères (you may be surprised that there are confrères this far from a large medical center) that I was making no effort to transform my "cold" cases into dysentery cases, and now I wish I had not for I fear I lost caste or something. One of my confrères recently purchased a full barrel of aromatic cascara. Do you think he got enough?

In your reply you may treat lightly my personal problem for I have practically decided to maintain the *status quo;* but I am very much interested in the present attitude of advanced medicine with regard to laxatives for bunions, etc. I am of the opinion that there are something like a hundred thousand of your readers interested in this subject.

What laxative works best in a poultice?

E. O. Harrold, M.D., Marion, Ind.

MONOGRAPH ON BONE SARCOMA

Among the Abstracts of Current Literature this month will be found one peculiarly worthy of mention owing to its length and the labor entailed in its production by Dr. L. R. Sante. The paper which he abstracts is a remarkable one, by Dr. Anatole Kolodny, to which the American College of Surgeons devotes an entire special number of 214 pages, with 104 illustrations. Dr. Kolodny is to be congratulated upon his monograph, which he dedicates to "the organizer of the Registry of Bone Sarcoma of the American College of Surgeons and the first Registrar, Ernest Amory Codman, M.D., whose tireless work and idealism have inspired a generation of students in their investigation of bone tumors." The classification and illustration of the work are such as to render it a most useful text for surgeons, general practitioners, and roentgenologists, and by its presentation *Surgery, Gynecology and Obstetrics* has still further placed the medical profession under obligations of gratitude.

CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS

The American College of Surgeons will hold the seventeenth Clinical Congress in Detroit, October 3-7. Headquarters will be at the Book-Cadillac and Statler hotels, and the meetings will be held at the Statler Hotel, and Orchestra Hall. The Hospital Standardization Conference will extend from Monday morning to Thursday afternoon and will include a discussion of hospital and nursing problems and hospital demonstrations. Monday evening's program will include an address of welcome by the local Chairman, the address of the retiring President, the inaugural address of the new President, and the John B. Murphy oration. Clinics in general surgery will be held in the Detroit hospitals each morning from Tuesday to Friday, and in eye, ear, nose and throat work the same afternoons. Clinics will also be held at University Hospital, Ann Arbor, Tuesday to Thursday. On Tuesday and Wednesday mornings and afternoons, and on Thursday morning, clinical demonstrations will be held at the Statler Hotel (mornings) and Orchestra Hall (after-

noons). On Thursday afternoon the annual meeting of the Governors and Fellows will be followed by a cancer symposium. On Friday afternoon there will be a symposium on traumatic surgery, to be participated in by leaders in industry, labor, indemnity organizations, and the medical profession. On Tuesday evening the program will take the form of a celebration of the Lister Centennial. On Thursday evening there will be a large Community Health Meeting in the Masonic Temple, and on Friday evening the Annual Convocation of the College. Other outstanding features will be the exhibits. In addition to the commercial exhibits there will be a replica of the Lister exhibit at the Wellcome Museum of Natural History, London, including Lister's operating rooms and hospital wards. The Departments of Hospital Activities, of Literary Research, and of Clinical Research of the College will also present exhibits. Among the foreign guests will be Sir John Bland-Sutton, England; J. M. Munro Kerr, Scotland; Gordon Craig, Australia; Gustaf E. Essen-Moller, Sweden; S. A. Gammeltoft, Denmark. The retiring President is W. W. Chipman, Montreal, and the President to be inaugurated, George David Stewart, New York. The Lister oration will be delivered by W. W. Keen, Philadelphia. The Chairman of the Detroit Committee on Arrangements is Alexander W. Blain.

BOOK REVIEWS

FOURTH ANNUAL REPORT OF THE BRITISH EMPIRE CANCER CAMPAIGN, July 11, 1927. Pages 121.

The Fourth Annual Report of the Grand Council of the British Empire Cancer Campaign, which has just been received, is of considerable interest. Unfortunately, this report is too long to permit of a general review; only the salient features can be mentioned here. The Cancer Hospital Research Institute, directed by Dr. Archibald Leitch, have carried out experiments to test the validity of the ideas of Gye and Barnard and, while they have been able to confirm certain features of this work, they have been forced to conclude that "such evidence as we have does not support the virus theory." Other investigations have been carried out on the action of lead on cancer, but "no evidence was found at necropsy suggesting any destructive change in the cancerous tissue or any arrest of the process, but some normal vital organs had suffered damage." The kidneys showed extensive tubular degeneration in all cases. Focal necrosis of the liver with advanced fatty change was a common finding. Cerebral edema, probably secondary to renal lesions, was a marked feature of certain cases, and thrombosis of the vessels of the kidney and liver also were observed. Complete blood counts had been made in 222 cases of malignant disease subjected to roentgen therapy but these failed to reveal any striking abnormality due to irradiation. Another striking item in the report of this Institute is that, after examining 800 cases by means of the Wassermann reaction, the conclusion was reached that syphilis plays no important part in cancer in general and that the incidence of syphilis in cancerous cases was somewhat less than in the non-cancerous population.

The report of St. Bartholomew's Hospital Radiological Cancer Research Department emphasizes the value of irradiation in relieving the pain associated with many cancers. The report on cancer research at St.

Mark's Hospital indicates that papillomatous adenomata are present around the majority of carcinomata of the bowel, and specimens of multiple cancers of the rectum often develop within the papillomata, which are regarded as evidence of widespread irritation of the intestine.

The report of the Westminster Hospital Research Center is confined chiefly to two points: the radiotherapy of cancer of the tongue and attempts to develop a complement fixation test for cancer. With reference to cancer of the tongue, twenty cases of which have been treated, the statement is made that the primary lesion can be made to disappear in every case and that radium therapy in this situation presents great advantages over all other forms of treatment, including surgery and diathermy. On microscopic examination of sections from such irradiated tongues, large round cells having no resemblance to normal or pathologic cells were found. To determine the origin of these cells radium was inserted into the tongue of several guinea pigs, and similar cells were found later. Therefore, these peculiar large round cells are not due to the presence of cancer in the tongue, because they are also found in irradiated normal tongues. The attempts to evolve a complement fixation test for cancer have not been satisfactory and the Shaw-McKenzie reaction has been found unreliable.

At the Coomb Lying-in Hospital, at Dublin, estimates were made of the nonprotein nitrogen, blood urea, and blood sugar before and after roentgen irradiation of patients with cancer, but no significant change was found. Hieger, working at the Cancer Hospital Research Institute on the action of radium and X-rays on cholesterol, was unable to find any difference between the cholesterol content of irradiated and control mice. Professor D. P. D. Wilkie, of Edinburgh University, reports experiments conducted to test the hypothesis of Gye, and these experiments appear to have confirmed this hypothesis in several particulars. This result is somewhat at variance with the results obtained at the Cancer Hospital Research Institute.

A. U. DESJARDINS, M.D.

THE QUARTZ MERCURY VAPOUR LAMP. By J. BELL FERGUSON. Paul B. Hoeber, Inc., New York, 1927. Pages 105. Price $2.50.

This little book of some hundred pages is really a very good summary of practical ultra-violet therapy. It contains much meat for the novice, and its Chapter VII on Practical Notes is especially commendable, though dealing with English lamps and prices.

The physical and chemical phases are briefly discussed. The dosage and dangers of ultra-violet are emphasized. The diseases in which the author recommends its use are illustrated by cases, though frequently some of the detail could well be omitted. There is also a short chapter of interest on the use of Vitaglass, showing increase in weight, height, and hemoglobin of schoolboys in rooms where this glass had been installed, as compared to control groups in rooms with ordinary glass.

Two pages of references furnish additional sources of information for those interested.

RADIOTHERAPIE. By W. VIGNAL. G. Doin & Co., Paris, 1927. Pages 424, 67 figures. Price 25 francs.

This is a small, cheaply published, but otherwise excellent book, the aim of which is to make available to the general practitioner and the student concise information on the possibilities and limitations of radiotherapy, including roentgenotherapy, radium therapy and actinotherapy. It is divided

into two parts: one dealing with fundamental principles and apparatus; the other with practical application, indications and contra-indications, results and technic. The outstanding defect of the book is its excessive brevity, especially in the part devoted to practical application. Controversial points have been wisely omitted, but the desire to be brief has been carried to such a length as to make radiotherapy appear more effective and technic more stabilized than they actually are. Through an oversight the radiotherapy of furunculus and carbunculus has been omitted. The work is a useful manual of general information, but is too limited in its treatment of the subject matter to interest the specialist.

A. U. DESJARDINS, M.D.

ABSTRACTS OF CURRENT LITERATURE

INDEX TO ABSTRACTS IN THIS ISSUE

Idiopathic epilepsy.—Oppenheim believes idiopathic epilepsy to be a toxicopathic condition with cerebral manifestations. Collier regards the disease as a metabolic dyscrasia. Little is known regarding the chemistry of the content of the cecum and ascending colon. With roentgen-ray evidence of general ptosis and colonic stasis in a girl of eleven the cecum and ascending colon were removed and a remarkable improvement followed.

C. G. SUTHERLAND, M.B. (TOR.)

The Relation of the Cecum and Ascending Colon Content to Idiopathic Epilepsy. G. E. Armstrong. Practitioner, November, 1926, p. 288.

Bone sarcoma.—One entire issue of *Surgery, Gynecology and Obstetrics* is given over to the consideration of bone sarcoma. The material used for this monograph is the material assembled by the Registry of Bone Sarcoma of the American College of Surgeons.

The author gives, in brief, the history of the Registry—how it came into existence, the scope of its work, and what it has accom-

plished. He discusses briefly the course of sarcomas of bone but comes to no other conclusions than those now prevalently accepted. He feels that undoubtedly trauma plays some part in their production.

The classification accepted by the Registry Committee is briefly reviewed and discussed. The Registry Committee classification embraces all bone lesions under eight headings.

1. Metastatic tumors primary in tissues other than bone.
2. Periosteal fibrosarcoma.
3. Osteogenic tumors: (*a*) benign and (*b*) malignant.
4. Inflammatory conditions.
5. Benign giant cell tumors.
6. Angiomata: (*a*) benign and (*b*) malignant.
7. Ewing's tumor.
8. Myeloma.

In the present article the author attempts to limit the discussion to primary sarcomatous bone tumors, so that only the following headings are discussed:

(*a*) Malignant osteogenic tumors.
(*b*) Periosteal fibrosarcoma.
(*c*) Angioma.
(*d*) Ewing's tumor.
(*e*) Myeloma.

Benign giant cell tumor is dealt with separately.

"'Osteogenic sarcoma' includes mainly the lesions which have been known for long as 'periosteal bone sarcoma.' The true meaning of 'osteogenic sarcoma,' under Registry definition, is 'a sarcomatous tumor derived from ancestors of cells which, when duly differentiated, are known as "osteoblasts" '"—in reality, an osteoblastoma. The Registry recognizes four anatomical types of osteogenic sarcoma.

1. Periosteal.
2. Medullary and subperiosteal.
3. Sclerosing.
4. Telangiectatic.

The author, from a consideration of the Registry material, differs somewhat. "Thus it is evident that no clear gross anatomical features distinguish the 'periosteal' type from the 'subperiosteal and medullary.'" Many investigators have urged the recognition of periosteal sarcoma. This is one of the best-known of bone tumors, owing to its radiographic manifestation of needles of bone projecting outward, perpendicular to the shaft. The author maintains that this picture is not an absolute indication of malignancy, but that a similar bone picture has been seen in low grade chronic infection, pyogenic or tuberculous.

"Sclerosing," a term given by Virchow, means that the intercellular substance of the tumor ossifies. A study of the Registry material showed no case in which sclerosing predominated throughout an entire tumor. The same tumor may show, in different areas, all of the various types of cell ordinarily found in bone tumors. Likewise, a sclerosing tumor, if studied throughout its entire life, frequently shows sclerosing at first, only to assume osteolytic characteristics later on during its development.

Telangiectatic osteogenic sarcoma, as the name suggests, is characterized by abundance of blood vessels. The walls of the dilated blood channels are very thin and pulsation can even be felt, giving rise to the term "bone aneurysm."

Periosteal fibrosarcoma, according to the Registry, is a tumor intimately connected with the periosteum, which leaves the cortex of the bone intact. Only very rarely is the cortex of the bone eroded. The majority of these tumors present a typical dense fibrosarcoma. The cases registered bear out the fact that this tumor offers a decidedly better prognosis than osteogenic sarcoma. The author objects to the use of the term "periosteal fibrosarcoma," since this at once brings to mind the more malignant "periosteal osteogenic sarcoma." The origin of periosteal fibrosarcoma is from the "fascicular" layer of the periosteum, while the "periosteal osteogenic sarcoma" originates from the cambial layer.

Angiomata of bone are benign and malignant. No case of malignant angioma of bone is registered.

Ewing's tumor was described first in 1920 as an anatomical and clinical entity. Before

1920, cases of this tumor were listed among round cell sarcoma and solitary myeloma. A specific clinical course, a typical gross anatomy, and a unique history serve as a basis for the existence of this entity. It affects young patients, rarely above 21 years of age, frequently beginning with a clinical picture resembling osteomyelitis. The response of the tumor to radiation is remarkable, although no definite cure from this source has yet been recorded. Metastasis to other bones is a characteristic feature of the terminal stage of this tumor, in divergence to osteogenic sarcoma in which bone metastases are very infrequent. The histological structure is at variance with any other type of osteogenic sarcoma. Ewing suggests the origin from the endothelium of the bone marrow, not, however, the vascular endothelium. It should not be confused with angio-endothelioma. The author feels that the word "tumor" should be replaced by "sarcoma"—Ewing's sarcoma.

Myeloma is a tumor originating in the medullary cavity of the bone, appearing simultaneously as numerous nodules ranging in size from a pin head to that of a walnut. A large majority are multiple tumors although solitary myelomas do occur. The tumor is held to be derived from the specific bone marrow cells of the myelocyte series. This is the only true round cell tumor occurring in bone. Myeloma recedes rapidly under radiation, but no absolute recovery from this agent is recorded.

In conclusion, the author feels that all primary malignant bone tumors can be subdivided in the following groups:

1. Osteogenic sarcoma.
2. Ewing's sarcoma.
3. Myeloma.
4. A group of unclassified sarcomata including, among others, such "near entities" as angio-endothelioma and extraperiosteal sarcoma.

Osteogenic sarcoma is a diffuse process of the bone. It is, therefore, impossible ordinarily to establish any definite point of origin of the growth, so that a distinction as to medullary, cortical, or periosteal origin is not justifiable. The cortex offers resistance to the growth of the tumor, so that it may spread throughout the entire medullary canal, literally stuffing the entire medullary cavity, while the radiograph indicates a tumor wholly limited to the area of involvement of the cortex and periosteal reaction. The self-defense of the involved bone is taken over by the periosteum. The periosteal reaction is the only morphologically condensed attempt of the organism to protect itself against the malignant invasion. In osteogenic sarcoma the old cortex is frequently seen passing through the tumor mass appearing grossly intact. Permeation rather than perforation of the cortex expresses better the pathological process; in Ewing's sarcoma, on the other hand, the cortex is usually broken up and displaced by the tumor. The gross structure of the tumor mass consists of stalactite-like rods of hyaline osteoid and osseous tissue radiating outward from the long axis of the bone. This gives the radiographic "sun-ray-like" appearance. The tumor may break through the cortex and invade the soft tissues; it may be covered over by the skin only but never cause skin ulceration. Cartilage is also resistant to osteosarcoma. Articular cartilages and epiphyseal junctions offer extreme resistance to the advancement of these tumors.

According to the degree of differentiation of osteogenic sarcoma these tumors are usually divided into two groups—osteoblastic and osteolytic, depending upon the degree of bone production or destruction. The tendency of all osteogenic sarcomas is to produce bone on some part of the tumor—no pure tumors of either type are ever encountered. Fibrous tissue, myxomatous tissue, cartilage, and then bone are the stages which these tumors go through.

The type of cell found in osteogenic sarcoma is the spindle cell. The characteristic peculiarity is the intercellular substance. All the varieties and shades of the intercellular substance encountered in osteogenic sarcoma may be grouped with one of the five types—hyaline, osteoid, cartilaginous, myxomatous, and osseous.

Clinical course.—Often from a good clinical history and roentgenograms, one can be

as sure of a diagnosis as from seeing the patient, the lesion, the gross specimen, and numerous sections. An estimate of the clinical instances of bone sarcoma shows one to one hundred thousand (100,000) population. It is primarily a disease of the young—the incidence of this tumor predominates in the second decade of life. The fact that the greatest frequency of osteogenic sarcoma is in the age of most active skeletal growth and development would seem to indicate that energetic growth of the skeleton is one of the main factors in the etiology of these tumors. The metaphyses of the long bones are the seat of predilection. The lower metaphysis of the femur represents the location of about 72 per cent of all bone sarcomas. Two features are present in most primary malignant bone tumors—pain and trauma. Pain appears before tumefaction, being due to the highly sensitive periosteum. Trauma is an unreliable element in the history, the main error being in consideration of what is to be understood as trauma. A sudden tension of a muscle on its insertion may supply sufficient trauma. The explanation of how trauma, such as fracture, can lead to sarcoma is answered by a loss of growth restraint after the repair of the fracture. Occasionally there may be a febrile stage, more common at the beginning and at the very termination of the course of the disease. Unlike carcinoma, the patient's condition is usually good until the last stages. The reaction of the overlying skin is also different from that in a case of carcinoma—the skin over sarcoma becomes stretched and even shiny, but never ulcerates. Pathological fractures are rare in bone sarcoma—pain and tumefaction usually keep the patient off his feet. Such tumors are restrained in their growth by the joint cartilage. It is interesting to note that bone sarcoma patients complain less of arthritic pain than patients suffering from osteomyelitis. Perforation of the mass into a blood vessel may result in widespread metastases. The lungs are most frequently affected. Metastases here can best be detected, especially when early, by X-ray examination of the chest. Typical pulmonary sarcomatous metastases are globular in shape, few in number, and large in size. Metastases occur also in other organs, especially bones. Skeletal chondroma is related clinically to osteogenic sarcoma. Malignancy tends to develop in cases of complete removal of benign chondromata.

Diagnosis is based upon clinical, roentgenological, and pathological findings. Not infrequently a roentgenogram is more decisive than a number of microscopic sections. All must be considered in the ultimate diagnosis. Tumors rich in blood supply may have pulsation, a condition which leads to their being called "bone aneurysms." Such pulsation within the tumor itself is one of the signs of malignancy. To read and interpret correctly a roentgenogram of a bone tumor is an art acquired only with wide experience, combined with a thorough knowledge of pathology. It still remains, however, a very important method of diagnosis.

In general terms, the following features of osteosarcoma frequently serve to differentiate it from other bone lesions: (1) Common absence of a definitely limited outline of the sarcomatous tumor; (2) Spindle-shaped investing capsule of the sarcoma, since it frequently spreads beneath the periosteum; (3) The wedge-shaped osteophyte at the margin of the periosteum, frequently spoken of as "lipping." These are not absolutely characteristic, however.

Roentgenographically, osteogenic sarcoma may be divided into osteoblastic and osteolytic types. In general, two types of ossification can be recognized:

(1) The structural dense bone which springs from or is attached to the involved old bone or as thin layers of osseous tissue parallel to the old shaft.

(2) The second type of ossification is structureless.

The most widely known appearance of an osteogenic sarcoma is the radiating type, extending out in needles of bone perpendicular to the shaft. This formation has been shown to be not absolutely pathognomonic of bone

sarcoma and has been seen accompanying an inflammatory condition.

A large expansion of the shaft is rather the exception in bone sarcoma. The shaft of a bone surrounded by a bone tumor and appearing normal on the X-ray is not to be considered free from involvement—involvement may be present and not show. Subperiosteal hemorrhage in hemophilia may give an appearance suggestive of osteogenic sarcoma. As a result of traumatic periostitis large tumors may appear which may be confused with it, but trauma rarely produces periosteal reaction entirely surrounding the shaft. Gumma sometimes resembles osteogenic sarcoma, but gumma grows less rapidly and regressive changes occur earlier; likewise there is absence of the periosteal spindle. One may be called upon to differentiate between chondroma and osteogenic sarcoma; the sharply outlined pedunculated base and the absence of the periosteal spindle will serve to differentiate. Osteolytic osteogenic sarcoma and central chondroma may be more difficult. In central chondroma the cortex is thinned, in contradistinction to osteolytic osteogenic sarcoma, where there is no thinning but honeycombed structure with thin well defined bony septa traversing in the roentgenogram the defect in osseous tissue. Differentiation from bone cyst is easier. The clinical similarity may be very great but a roentgenogram will determine the true character of the pathology. Bone cyst is always intra-osteal (central); there is expansion of the shaft; the cortex may become very thin but does not break through unless there is trauma. True osteogenic sarcomas usually occur at the ends of the bones. Ewing's tumor is most frequent in young individuals, near the middle of the shaft.

It is easy to understand why, when the differential diagnosis of bone tumors is uncertain by any single method, there exists a tendency to "explore." Although a biopsy of bone is frequently advocated by surgeons, it is significant that pathologists most experienced in bone tumors raise their voices against probatory incisions in cases of suspected malignant bone tumor. Danger of exploration lies not only in the possibility of dislodgment of cells, but in removing the barrier to the growth, and also the surgical insult of the incision. As a substitute for exploratory incision, a therapeutic radiation test has been suggested. The characteristic reaction to radium and X-rays may frequently replace a biopsy. Disappearance of pain and regression of the tumor after radiation are indications of its malignant nature. The most rapid response to radiation is seen in Ewing's sarcoma and cellular osteogenic sarcoma.

Therapy.—There is practically no advancement in therapy over that in practice fifty years ago. Coley's mixed toxins have no scientific basis for their use. Many advanced and inoperable cases which have responded to Coley's fluid have been proven to be giant cell tumors—a form of tumor which is notorious for spontaneous regression. Of late there has been a tendency toward the combined use of Coley's toxins with radium and X-rays, though there is no definite proof of the advantage of this combination. Until recently operative methods have been the means of choice. The advent of the Registry has proven that highly developed surgical technic alone cannot cure bone sarcoma. Either complete early eradication must be done, or nothing. Recently the value of radium and X-rays as therapeutic agents in treatment of bone sarcomas has been established. Even now, some clinicians are inclined to think that if a bone sarcoma is operable there is an indication for surgical treatment without losing time in radiation, while only the unoperable cases are to be left for radiation treatment. That this view is obsolete and not in accord with the disappointing results in radical surgery is obvious. It is true that no astounding success has yet been achieved by radiation therapy of malignant bone tumors, and that most results here are unsatisfactory; however, the evidence on hand is encouraging and radiation is as legitimate a therapeutic agent in bone sarcoma as surgery.

Prognosis is generally bad: it varies, of course, with various types of tumor. Adolescents are less able to withstand the dis-

ease than persons above 30 years of age. In children the prognosis is still worse.

Ewing's tumor varies from osteogenic sarcoma. It tends to involve the smaller bones of the hands and feet, and when it does involve the long pipe bones occurs in the shaft, not in the ends, in which it shows wide involvement. The gross anatomic appearance of Ewing's sarcoma is mainly the result of the aggressiveness of the tumor cells, of the protective defensive measures, of the affected bone, and of the regressive changes in the tumor mass. The tumor seems to begin simultaneously in several regions of the bone marrow and larger haversian canals. These rapidly enlarge, become confluent and show a great tendency to expand in all directions. The tumor cells spread among the lamellæ and soon become crowded for space, separating the tension and pressure lamellæ and making the bone appear thicker than normal. At an early stage the bone resembles that in osteomyelitis. A shell of new bone surrounds the weakened bone—later this is also perforated. Shell after shell is laid down. The spreading of the tumor through the haversian system, with the gradual destruction of the affected bone and the newly formed bony onion-like layers parallel with the shaft, result in the characteristic diffuse displacement of the bone by the tumor mass. Later necrosis occurs.

Structure.—This tumor varies from osteogenic sarcoma in that it is composed of small polyhedral cells with round-oval or slightly elongated nuclei and scant, clear, stainless cytoplasm. A striking feature is the complete absence of intercellular substance. Metastatic involvement of the regional lymph nodes in Ewing's tumor is not infrequent, and, unlike osteogenic sarcoma, it is likely to metastasize to other bones, especially the skull. The metastases resemble the original tumor. Ewing's tumor is not of blood vessel origin, but of endothelial cell origin, derived elsewhere in the medullary cavity.

The history and clinical course differ from those of osteogenic sarcoma. In 650 cases of bone tumor submitted to the Registry there are 40 instances of Ewing's sarcoma. About 7.5 per cent of all cases diagnosed as osteogenic sarcoma are Ewing's tumor. The male sex predominates three to one as to cases, and the most frequent occurrence is between 5 and 15 years of age. Myeloma occurs principally between 40 and 50 years. The long pipe bones are the favorite site, the order of frequency being tibia, fibula, humerus, ulna, and femur, although it also involves the shorter bones. When the spine is involved at least two adjoining vertebræ are the seat of the disease. A simultaneous osteogenic sarcoma of more than one bone is a curiosity, while this seems to be quite the rule in Ewing's sarcoma. In Ewing's tumor the history of trauma, combined with the complaints of pain and fever, sidetracks the physician toward an erroneous diagnosis of osteomyelitis. The pain is intermittent in character and may become rheumatoid. It is not unusual for a patient with Ewing's sarcoma to be up and around for more than a year. There is fever and may be a leukocytosis of 12,000 to 15,000, but showing normal differential count. There may be metastases to the regional lymph nodes. The overlying skin remains free. The terminal stage of Ewing's sarcoma is different from osteogenic sarcoma, the advent of metastases usually producing fever. Any of the organs of the body may be involved, from which period the patient emaciates rapidly and dies.

Diagnosis.—From the roentgenogram, it is often mistaken for osteomyelitis at the outstart, for which reason the diagnosis must be made only after consideration of all data. A roentgenogram of an early Ewing's sarcoma will show a diffuse involvement of the bone, probably due to a diffuse origin of the tumor in the haversian system. The diaphysis is involved, not the ends of the bones. The bone is slowly displaced by the tumor mass. The shaft cannot be seen running through the tumor. New bone is laid down parallel to the shaft—only rarely is the radiating type observed. In Ewing's tumor microscopic diagnosis is less reliable than in osteogenic sarcoma.

Therapy and prognosis.—This type of sarcoma responds more readily to radiation than any other type. Heavy radium and X-ray

treatment causes suppression of Ewing's sarcoma and regression of the tumor. It slowly recurs, however, and later becomes refractory to further radiation. There are patients on record who have been well four years on whom radiation alone was used.

Myeloma is a very rare condition. This tumor favors the mid-portion of the bone, especially the humerus and femur and flat bones—scapulæ, skull, sternum, ribs, and vertebræ. The tumor forms nodules varying in size from that of a bean to that of an orange. It spreads along the medullary cavity, and there is some expansion of the transverse diameter of the bone. The cancellous bone literally melts before the invasion of the tumor cells. The cortex becomes eroded and the tumor protrudes beyond the periosteum. Repeatedly the periosteum forms new layers of bone, each one of which is pushed aside and perforated, and the tumor invades the soft structures.

Structure.—Histogenesis is still not clear. Tumors have been described as originating from each of the basic cells of bone marrow, myelocytes, lymphocytes and mononucleated red cells. The majority of myelomas are composed of mononuclear non-granular cells. While cell structure varies somewhat, this type of tumor is so rare that subdivisions into classes are hardly justifiable.

Clinical course.—Neither the history nor the physical examination of a patient with myeloma in the early stage yields anything in any way characteristic of the disease. It affects males chiefly, between 40 and 60 years of age. In the advanced stages it extends throughout most of the bones, not infrequently replacing the entire bone marrow. Pain is an important factor, but never comes on until later. With extensive destruction of the bone marrow a secondary anemia appears. Pathological fractures occur.

Diagnosis.—Radiology is the main diagnostic method of value. In a far advanced case the multiplicity of involvement suggests multiple myeloma rather than Ewing's sarcoma. The absence of pulmonary metastases in the presence of very extensive skeletal involvement is the rule in myeloma. Albumosuria and the presence of Bence-Jones proteins in the urine have been observed, but are not always present. The bone may be slightly expanded by the individual nodules, giving the thinned cortex a wavy appearance, but breaking of the cortex is rare.

Therapy and prognosis.—This tumor is composed of lymphoid cellular elements and therefore is very readily affected by radiation. Any effect is temporary, however for death follows from extension of the process. It is a question whether continuation of radiation is permissible after the leukocyte count reaches 2,500. Cases are on record in which ten or more years have passed between the clinical onset and fatal termination.

Unclassified sarcomas.—Aside from a few atypical instances this group includes angio-endothelioma and extra-periosteal sarcoma of bone.

Angio-endothelioma is very rare—only two are registered. Clinically these tumors resemble osteogenic sarcoma so closely that they are commonly grouped together, and it is doubtful if any differentiation could be possible roentgenographically.

Extra-periosteal sarcoma is a tumor intimately related to the periosteum, but entirely extra-cortical, not invading or infiltrating the bone. The tumor arises from the fibrous periosteal layer, not the bone-producing cambial layer. This specific fibrous tissue is incapable of producing new bone. These tumors remain encapsulated for a long time, merely pushing aside the soft tissues. These tumors may, by pressure, cause slight erosion or absorption of the cortex. Little aid can be expected from the roentgenograph in differentiating this tumor from soft-part sarcoma.

Giant cell tumor.—The abundant occurrence of giant cells in a tumor is not sufficient to establish the tumor as a giant cell tumor. There are three types of giant cells: (1) Giant cells which are the result of karyorrhexis in the cellular elements of the tumor, where in rapidly growing tumors the cytoplasm cannot keep pace with the rapid division—these are termed true giant cells; (2)

foreign body giant cells, which occur in gumma and tuberculosis, and (3) giant cell of giant cell tumor, having nuclei uniformly distributed throughout the central portion of the cell, equal in size and separated from each other. These only should be considered of giant cell tumor type.

Pathology.—These tumors, during their period of growth, constantly destroy the bone, while the periosteum lays down an advancing shell of new bone, thus preventing the tumor mass from an early perforation of the bone. This produces a typical roentgenographic picture sometimes likened to "soap bubble" appearance. The articular cartilage is highly resistant to the growth and there is usually a limiting membrane. The typical giant cell tumor, then, consists of solid portions and numerous small cysts.

Structure.—The histological structure consists of typical giant cells and the stroma. The histogenesis of this cell is still a subject of discussion.

Clinical course.—The relative frequency of giant cell tumor as compared with malignant bone tumor is as one to two. Most giant cell tumors occur between the ages of 16 and 25, the youngest patient being 6 years and the oldest 68 years. Trauma is given as an important factor in etiology of this tumor.

Diagnosis.—The diagnosis is often impossible from microscopic examination alone—the clinical history likewise may not be decisive. The X-ray picture is usually quite characteristic with the trabeculated bony network surrounding the tumor.

L. R. SANTE, M.D.

Bone Sarcoma: The Primary Malignant Tumors of Bone and the Giant Cell Tumor. Anatole Kolodny. Surg., Gynec. and Obst., April, 1927, XLIV, Part II, No. 4, A, pp. 1-214.

Adrenal tumors.—Dr. Gibson discusses this subject, giving the incidence in the University of California Hospital as being 1 case in 5,000 admissions. Pathologically these neoplasms fall into cortical tumors (carcinomas) and medullary tumors (sarcomas). Other types of tumor are too rare to be included in the discussion. The adrenal tumors give rise to three distinct syndromes: (1) The genito-suprarenal syndrome; (2) the Hutchison syndrome, and (3) the Pepper syndrome. The author discusses the differential diagnosis and treatment. Under the latter he says: "The treatment of adrenal tumors is surgical and radiological. No statistics are available regarding deep X-ray treatment, but it should be tried where surgery is contra-indicated. From a surgical point of view the prognosis is almost uniformly bad." He then gives an analysis of the nine cases recorded at the University of California Hospital.

F. B. SHELDON, M.D.

The Diagnosis of Adrenal Tumors. Thomas E. Gibson. Calif. and West. Med., February, 1927, p. 201.

Multiple sarcoma.—This is the history of a patient suffering from an advanced sarcoma in the region of the twelfth thoracic and first lumbar vertebræ, with metastases to the sternum and pancreas. A series of deep therapy treatments over all involved regions led to a clinical cure.

E. A. POHLE, M.D.

Cured Case of Multiple Sarcoma. Eugen Sattler. Strahlentherapie, 1927, XXV, 190.

Hematoporphyrin as sensitizer for ultra-violet rays.—The authors investigated the sensitizing properties of hematoporphyrin for ultra-violet radiation. An ultra-violet spectral apparatus (U. V. monochromator), built according to the advice from the Finsen Laboratory in Copenhagen, and a mercury vapor lamp were used. As biological object, they chose red blood corpuscles. It appeared that the optimum sensitization of erythrocytes by hematoporphyrin for ultra-violet was at

lambda, equal to 3,130 Ångstroms; there was some influence at 2,800 and 2,650 Ångstroms. It is possible that in diseases like hydroa, where porphyrin is excreted, this substance serves as sensitizer for ultra-violet. Search for a similar effect for other photodynamic substances in the ultra-violet region should be made.

E. A. POHLE, M.D.

Regarding the Sensitizing Effect of Hematoporphyrin in the Ultra-violet Region. W. Hausmann and C. Sonne. Strahlentherapie, 1927, XXV, 174.

Gall-bladder drainage.—The essayists for purposes of examination recalled a series of patients on whom the gall bladder had previously been drained and not excised, with the object of determining by cholecystography whether or not a pathological condition of the organ persisted.

From a consideration of these cases they came to the following conclusions:

"1. Cholecystograms were made on twelve patients at varying intervals, following cholecystostomy. Not one of them showed a normally functioning gall bladder as demonstrated by the cholecystogram.

"2. Six of the patients experienced a return of symptoms severe enough to necessitate surgical relief. Four of these showed a recurrence of gallstones at operation; the remaining two showed fibrosis and thickening of the gall-bladder wall, the microscopic diagnosis in all cases being chronic cholecystitis.

"3. Laboratory experiments were undertaken to study the effect of different types of injury to the gall bladder upon the subsequent cholecystograms and thus to obtain further evidence as to the significance of the findings in those patients in whom no operation was performed. It was found that a severely damaged mucosa prevented shadow formation, and that injury to the musculature of the gall bladder inhibited emptying after the ingestion of fat, the conditions being as nearly comparable as they could be made to the cholecystic disease in the patients not subjected to operation.

"In conclusion, it would seem that the drainage of a diseased gall bladder with the expectation that it will regain its normal function is not only a futile procedure but one that endangers the future health of the patient."

L. R. SANTE, M.D.

End-results of Cholecystostomy as Shown by the Cholecystogram. Roy G. Spurling and Lester R. Whitaker. Surg., Gynec. and Obst., April, 1927, XLIV, 463.

Pulmonary experimental work.—Many men have made unsuccessful attempts to produce pulmonary abscesses experimentally by the introduction of infected material directly into the thorax or into the respiratory tract. Working in the surgical laboratory of the Western Reserve University, Holman, with the collaboration of Weidlein and Schlueter, recently developed a simple procedure for the production of pyogenic pulmonary abscesses. Small bits of infected tonsillar tissue were introduced into the jugular vein. These were carried by the circulation to the lung, where they lodged and gave rise to pulmonary suppuration.

The authors summarize as follows:

"Tuberculous emboli introduced into the jugular vein were arrested in the pulmonary circulatory bed, where they initiated pathological changes in the pulmonary tissue resulting successively in anemia, infarction, caseation, central softening, and abscess formation. The earliest appearance of a well-defined abscess following the introduction of the tuberculous embolus was on the twelfth day, whereas pyogenic emboli produced abscesses within four and six days.

"The pathological changes initiated by pyogenic emboli took various forms: (1) limited consolidation about the embolus with early recovery; (2) hemorrhagic infarction with recovery or with central softening and abscess formation; (3) massive hemorrhagic consolidation and death.

"A relative lymphocytosis accompanied the

tuberculous processes in the lungs, as contrasted with a true polymorpholeukocytosis that characterized the pyogenic processes.

"The embolus as such produced only slight changes in the pulse and the respiratory rates. It was only when the effect of the accompanying infection made itself felt, that is, after the lapse of 12 to 24 hours, that the pulse rate and respiratory rate became elevated.

"Positive blood cultures were obtained in a number of instances as early as 24 hours following the introduction of pyogenic emboli. The bacteriemia was frequently only temporary, and the animals fully recovered. In three instances the animals died, and a complicating septicemia probably accounted for the death of two other animals.

"The embolus, introduced with the animal in the supine position, usually followed the main current in the pulmonary artery, lodging in the left lower lobe 14 times, in the right lower lobe 11 times, in the left upper lobe twice, in the right upper lobe once, and in the right middle lobe once.

"Good healing of the bronchial stump occurred in every instance following an atraumatic inversion of the stump by sutures placed in the peribronchial tissues.

"The uniform and invariable pathological changes which followed the introduction of a tuberculous embolus into the jugular vein suggest that this experimental method may lend itself to a study of certain much mooted questions, such as the effect of tuberculin in establishing immunity, the pathway of tuberculous infection, the value of therapeutic agents both surgical and medical, and other like problems in the realm of tuberculosis."

L. R. Sante, M.D.

Experimental Studies in Pulmonary Suppuration. Emile Holman, L. R. Chandler, and C. L. Cooley. Surg., Gynec. and Obst., March, 1927, XLIV, 328.

Duodenal obstruction and dilatation.—Wilkie discusses the pathology, diagnosis, and treatment of duodenal obstruction and dilatation, usually termed "chronic duodenal ileus," from his observation of 75 cases, all of which were seen at operation. He emphasizes the difficulty of diagnosis because of the indefinite history, which usually resembles that of chronic gall-bladder disease, and the varied physical findings usually presented. In practically all of the cases diagnosed before operation, the diagnosis was made only after roentgenography. The enlarged duodenum is best seen about one and one-half hours after ingestion of the meal. Four hours after, a saucer-like residue in the dilated first and third portions of the duodenum forms a characteristic picture. However, in many cases manifesting a history of recurrent disease a roentgenographic examination in one of the latent intervals does not show anything conclusive; in these cases, operative treatment does not give nearly the satisfactory results seen in the cases definitely recognized by the X-ray. The use of cholecystography has tended to narrow the margin of error in the differentiation from gall-bladder disease. Several cases were operated on following a roentgenographic diagnosis of gastric or duodenal ulcer, the coincidence of the two conditions being very frequent.

As regards treatment, in those cases in which the duodenum was found to be obviously obstructed by gross anatomic abnormality or by pathologic processes in the root of the mesentery, the results of a duodenal jejunostomy were excellent. However, in the cases operated on in which no detectable mechanical obstruction could be found, especially in the visceroptotic, the short-circuiting operation gave very uncertain results. In no case, however, was the patient made worse by operation.

Robert A. Arens, M.D.

Chronic Duodenal Ileus. D. P. D. Wilkie. Am. Jour. Med. Sci., May, 1927, p. 643.

Spontaneous rupture of diaphragm.—This is a case report of a rupture of the diaphragm which occurred while the patient was asleep in bed. The X-ray examination showed that the stomach and transverse colon were in the

left chest, with the left diaphragm unvisualized. At operation a recent rupture of the left diaphragm was discovered. This was enlarged, the stomach and transverse colon returned to the abdominal cavity, and the rent sutured. The musculature of the dome of the left diaphragm was found to be attenuated and atonic.

The only explanation of the rupture was the giving way of this congenitally defective diaphragm during one of the attacks of flatulence from which the patient habitually suffered.

L. J. CARTER, M.D.

Spontaneous Rupture of the Diaphragm. Bernard R. Mooney. Can. Med. Assn. Jour., April, 1927, p. 447.

Gastric ulcer.—White discusses the management of the gastric ulcer from the internist's viewpoint. In this article he lays emphasis upon the accuracy of the modern diagnosis of this condition, which he claims is (without operation) 90 per cent, and which he ascribes largely to the introduction of the X-ray. The roentgenograph does this not only by discovery of the ulcer defect and its localization in the stomach or duodenum, but also, through the Graham test and other methods, by excluding pathologic gall bladders and appendices which clinically simulate ulcer. This method, he says, will necessitate a new set of medical ulcer statistics.

In following the results of medical treatment he depends not only on symptomatic improvements but also upon regularly repeated occult blood tests and upon X-ray re-examinations of the stomach one to two weeks after treatment, again after one or two months, and still again at a later date. This method enables the clinician in a large degree to follow the course of healing, for it is important to know just what an ulcer is doing under treatment. In a healing ulcer, especially on the lesser curvature, the peristalsis can be seen to become less active, the pyloric spasm lessens, the emptying time improves, and the ulcer defect disappears, the crater filling up, and the edges smoothing out often in from one to two weeks. In pyloric ulcer, deformity may be seen to be persistent, due to spasm or scar tissue. These changes are carefully correlated with changes noted clinically; however, the clinical changes are usually subordinate in importance, inasmuch as a patient may lose his symptoms and gain weight with no healing whatsoever, the X-ray alone showing the severity of the lesion.

White doubts the objection of some that this method is unreliable because of a possible filling of the crater with gastric contents, but admits that it calls for very careful interpretative work. He has checked this method by operation in several cases, and has found the rapid healing of ulcers as described to be a fact. He shows it graphically in this article with radiographs of two cases in which the progress in healing proceeds to the point of actual disappearance of the ulcer deformity.

ROBERT A. ARENS, M.D.

The Medical Treatment of Ulcer of the Stomach. Franklin W. White. Am. Jour. Med. Sci., May, 1927, p. 629.

Malignancy of testicle and scrotum.—This paper is a preliminary report of four cases of seminoma of the testicle treated by orchectomy and deep X-ray, and a very rare sarcoma of the scrotal raphé. Dr. Wesson takes up the etiology and diagnosis of these cases. The classification of testicular tumors is in the following two groups: (1) the seminoma of Chevassu, a single cell tumor of solid medullary large cell type derived from the cells of the spermatic tubules, and (2) teratoma or mixed tumor. The treatment is of three types: (1) simple castration; (2) radical operation for teratoma, and (3) castration and radiation for seminoma. The simple castration is justifiable only in the case of benign tumors. When tumor cells have passed beyond the primary field the case is considered inoperable. There are three objections urged against the radical operation: (1) the im-

possibility of removing the lymphatic field without grave injury to vital structures; (2) the high operative mortality of 12.4 per cent, and (3) the risk of operation when in so many cases the tissue removed shows no metastasis.

The ideal method is low voltage treatment of the testicle and deep therapy to the abdomen, repeated in two months, the testicle having been removed in the interim. As a rule, however, the patient is not going to submit to radiation until a positive diagnosis of malignancy is made; therefore in these cases the operation was done first for the diagnosis by frozen sections.

If radiation is good in any form of cancer it will cure seminoma and metastasis, because these are slow-growing and are from the sex cells, which are very sensitive to the ray. The hope for the sufferer lies in early diagnosis, operation before metastasis has entered the primary field, and—in the case of seminoma—two thorough courses of deep therapy.

F. B. Sheldon, M.D.

The X-ray and Conservative Surgery in the Treatment of Malignant Tumors of the Testicle and Scrotum. Miley B. Wesson. Calif. and West. Med., May, 1927, p. 648.

Cholecystography. — Attention is again called to the principles which underlie the test. Any substance used for cholecystography must be excreted by the liver and pass with the bile into the gall bladder. Here it must be concentrated by the absorption of water in order to give the densest shadows. Obviously, then, the densest shadows will be found in normal subjects. If the cystic duct is occluded, there will be a faint shadow or even none at all. Another condition which may result in failure to secure a shadow is the inability of the gall bladder to concentrate its contents because of a diseased wall and its inability to secrete the substance. Since the presence of food in the duodenum is accompanied by an outpouring of bile the necessity for fasting during the period of concentration of the substance in the gall bladder becomes evident. Cholecystography, then, is a means of studying the functional activity of the gall bladder rather than a means of determining the exact pathological lesions present. In spite of this fact many writers speak erroneously of an absence of shadow as a "failure of filling."

Much investigative work has been done with the aid of this method on the only two functions of the gall bladder which we know to exist: the ability to concentrate its contents and the ability to store bile. In the essayist's experience of 1,246 patients examined by this method, 147 have been operated on and in 143 of these 147 cases the gall bladder was subjected to microscopic examination and a correct diagnosis was found to have been made in 97 per cent. The results of others published in the literature are tabulated and show 97.8 per cent. The percentage of correct diagnoses by oral methods was given as 89 per cent.

The essayist points out that he does not consider that the ideal substance for cholecystography has been found, and calls attention to the fact that he and his co-workers have developed 43 substances, 12 of which have been able to make the gall bladder visible. He considers the less toxic action of phenoltetraiodophthalein, a new substance produced over the original substance, tetraiodophenolphthalein, a distinct advantage, but adds that it is very expensive. It has cut down the number of undesirable reactions more than 50 per cent for the intravenous method.

The essayist next takes up the subject of the mechanism of emptying of the bladder and details experiments which have been carried out to throw light on this important subject through cholecystography. His conclusions are that the gall bladder empties itself of its contents through the cystic duct by the washing out of its contents by bile from the liver, by the elasticity or contractile mechanism of its walls, and by variations of intra-abdominal pressure. In the light of new investigation he feels that the actual contraction of the gall

bladder must be added as at least a contributing factor, but not the main one.

L. R. SANTE, M.D.

The Present Status of Cholecystography and Remarks on the Mechanism of Emptying of the Gall Bladder. Evarts A. Graham. Surg., Gynec. and Obst., February, 1927, XLIV, 153.

Interpretation of shadows in the urinary tract.—In the interpretation of shadows in roentgenograms of the urinary tract, the following are the most common causes of confusion: (1) localized areas of tissue calcification, such as calcified lymph nodes, and irregular mottled areas occurring in the renal parenchyma as a result of calcium deposition in renal tuberculosis, in hypernephroma, and in pyogenic abscesses which have undergone resolution with calcification; (2) gallstones; (3) multiple shadows, one or more of which require identification and localization, and (4) the shadows of multiple stones in the kidney not necessarily having similar characteristics, so that, while the shadow of one stone may be typical of renal lithiasis, the other may be suggestive of an extrarenal shadow. Because of the similarity of various shadows seen in the roentgenogram, the exact nature of them can be determined only by the pyelo-ureterogram.

The authors recommend the use of 12 per cent sodium iodide or 15 per cent sodium bromide; of these two, the former is preferable. To sterilize either use autoclave sterilization or add 1 dram of mercuric iodide in 3,000 c.c. of 12 per cent sodium iodide. The only precaution necessary is to guard against overdistention—the medium can be injected with a syringe but injection must be stopped as soon as the patient complains of the slightest pain.

Although the deformities seen in the various lesions of the kidney and ureter are usually peculiar to the various diseases, thus rendering their recognition possible, nevertheless the various types of pelvic deformity may so closely resemble one another that their differentiation may be very difficult. Correct interpretation of a pyelogram is based upon familiarity with the variations in outline of the normal pelvis. Elongation of one or more calyces is frequently seen in a normal pelvis and may be so extensive as to suggest neoplasm. However, the outline of the minor calyces will be normal.

The normal pelvis and calyces may be large, suggesting hydronephrosis: usually comparison with the pelvis of the kidney gives the key to the size normal for the individual.

Incomplete filling of the pelvis is a frequent source of error. Blood clots may cause apparent filling defects.

In spite of an ideal medium and every technical precaution, urography should not be made a routine.

Definite contra-indications are: (1) age or great emaciation of patient; (2) advanced and bilateral renal disease; (3) the apparent lack of benefit from surgical treatment.

The normal kidney is not fixed. It is difficult to place any arbitrary limits on its movability.

Ptosis of the kidney is common, especially on the right side. This can be demonstrated by downward displacement of the kidney seen in radiographing in the upright position.

The article is profusely illustrated with ureteropyelograms.

L. R. SANTE, M.D.

Ureteropyelography. William F. Braasch and Benjamin H. Hager. Surg., Gynec. and Obst., April, 1927, XLIV, 433.
